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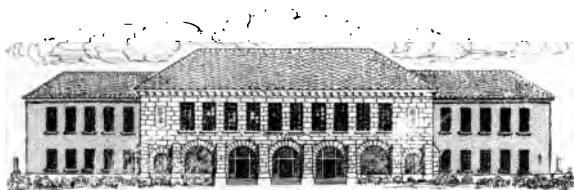


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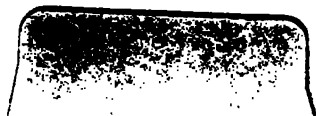


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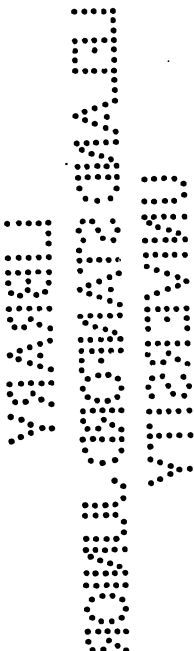
BY

S. W. BAIRD

PRINCIPAL FRANKLIN GRAMMAR SCHOOL, WILKESBARRE, PA.

SEVENTH YEAR

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GRADED WORK IN ARITH. VII.

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NOTE.

THE book begins with a thorough review of the work of the preceding years, the principles already developed being applied to problems of greater difficulty.

The chapter on denominate numbers lays particular stress on circular measure, and on longitude and time. Practical mensuration is completed. The treatment of percentage and its applications—commission, trade discount, taxes, insurance, and interest—is continued and extended. The subjects introduced for the first time in this book are duties or customs, commercial forms, bank discount, exchange, and simple and compound proportion. Under areas and volumes is included a discussion of areas of prisms, cylinders, pyramids, and cones, and of volumes of cones and pyramids.

As in the preceding books, the method of treatment is largely inductive. By means of illustrations and carefully graded questions the pupil is led to see the reason for the various processes, and is encouraged to formulate his own methods of operation.

CONTENTS

	PAGE		PAGE
REVIEW WORK	5	PERCENTAGE	50
DENOMINATE NUMBERS . .	20	COMMISSION	55
Circular Measure . . .	20	TRADE DISCOUNT . . .	58
Latitude and Longitude .	23	TAXES	60
Longitude and Time . .	26	Duties or Customs . .	62
Standard Time	30	INSURANCE	66
PRACTICAL MENSURATION .	34	INTEREST	70
Measurement of Land . .	34	COMMERCIAL FORMS . .	84
Lathing and Plastering .	34	BANK DISCOUNT . . .	91
Painting and Papering .	35	REVIEW WORK	100
Carpeting	36	EXCHANGE	107
Wood and Lumber . . .	37	RATIO AND PROPORTION .	111
Masonry	38	Ratio	111
Roofing	40	Proportion	112
Capacity of Bins . . .	41	AREAS	121
Capacity of Cisterns, etc..	42	VOLUMES	134
REVIEW WORK	44	REVIEW WORK	137
		TABLES	146

REVIEW WORK

LESSON 1

1. Change $\frac{1}{2}$ to 4ths; 6ths; 8ths; 14ths.
2. Change $\frac{3}{4}$ to five equivalent fractions of higher denominations.
3. Find the sum of $\frac{2}{3}$ and $\frac{5}{7}$; $\frac{5}{8}$ and $\frac{3}{7}$; $\frac{3}{7}$ and $\frac{5}{8}$.
4. $.4 + \frac{3}{5} + \frac{1}{2} = ?$ $.33\frac{1}{3} + \frac{2}{3}$ of $.9 =$ how many 30ths?
5. What number diminished by 3.2 leaves $4\frac{1}{10}$?
6. $\$1 - 37\frac{1}{2}\%$ of a dollar equals what part of a dollar?
7. When coal is worth $\$6$ a ton, how much are 300 lb. worth?
8. Find $.62\frac{1}{2}$ of 30. What part of $\frac{4}{10}$ is $\frac{5}{100}$?
9. How many ounces in .05 of a pound avoirdupois weight?
10. Find the cost of $66\frac{2}{3}\%$ of a gallon at 10¢ a pint.
11. How much are 126 lb. of wheat worth at 80¢ a bushel?
12. If I pay $\$22\frac{1}{2}$ for the insurance, at $\frac{3}{4}$ of its value, of a stock of goods valued at $\$1800$, what is the rate?
13. If an article is bought for $66\frac{2}{3}\%$, and sold for 75¢, what is the per cent of gain?
14. The cost is $\$3$; the gain is 30%. Find the selling price.
15. The cost is $\$6$; loss, 40%. Find the selling price.

16. If the cost is $\$10\frac{1}{2}$, and the selling price $\$12\frac{1}{2}$, what is the gain per cent?

17. The cost is $\$20\frac{1}{2}$; the selling price $\$12\frac{1}{2}$. What is the loss per cent?

18. What is a rectangle? What are the dimensions of a rectangle?

19. Draw a rectangle whose area is 5 A., and state dimensions.

LESSON 2

1. Change £25 15s. 6d. to United States money.

2. If a man can travel 29.6 mi. in 1.6 days, how far can he travel in 13 days?

3. A cellar measures 47 ft. long and 17 ft. wide inside the walls. The wall is 6 ft. high and $1\frac{1}{2}$ ft. thick. How many cubic feet of masonry does it contain?

4. Find the cost of 36 A. 6 sq. ch. of land at \$30 per A.

5. A board 20 ft. long contains 15 board feet. How wide is the board?

6. If the cost of 49 lb. of flour is $\$1.22\frac{1}{2}$, what is the cost of a barrel?

7. A bin 8 ft. long, 6 ft. wide, and 4 ft. deep is half full of wheat. What is its value at \$.75 a bushel?

8. How many 2-in. cubes equal a cubic yard?

9. $\frac{3}{4}$ of a foot is what part of a rod?

10. If 14 bu. of potatoes are worth \$11.90, how many bushels can be bought for \$74.80?

11. How many barrels of water are contained in a cistern 6 ft. square and 4 ft. deep?

12. A man earns \$3.40 a day. How long will it take him to earn \$271.15?

13. How long will it take a passenger train to go 68 mi. at the rate of 15 mi. in 25 min.?

14. How many board feet in ten 12-ft. boards 10 in. wide?

15. If $\frac{3}{4}$ of the cost of a dozen buttons is \$.72, what is the cost of $1\frac{1}{2}$ gross at the same rate?

16. If a yard of cloth costs \$4, what part of a yard can be bought for $\$ \frac{3}{4}$?

17. A owns 60% and B owns 40% of a farm. A's share is what per cent of B's? B's is what per cent of A's?

18. How many rods equal a mile? How many yards equal $3\frac{1}{2}$ rd.? How many feet equal $7\frac{1}{2}$ rd.?

LESSON 3

1. A furniture factory is insured for $\frac{3}{4}$ of its value, at $1\frac{1}{2}\%$. If the premium is \$300, find the valuation of the factory.

2. $\frac{3}{4}$ of 22 yd. of silk is $1\frac{1}{2}$ of the number of yards required for a dress. Find the number of yards of silk in the dress.

3. The parallel sides of a trapezoid measure 160 rd. and 200 rd. respectively, and the area is 32,400 sq. rd. What is the perpendicular?

4. How wide must a board 12 ft. long be, to contain as many square feet as another board 20 ft. long and $\frac{3}{4}$ ft. wide?

5. The list price is \$250; rate, 40% and 10% off. Find the selling price.

6. Mr. Buckley bought 200 tons of coal (2240 lb. each) at \$2.75 per ton, and sold it at \$4.25 per ton of 2000 lb. How much was his total gain?

7. If $\frac{5}{11}$ of an acre of land is worth \$85.50, how much are $32\frac{7}{10}$ A. worth?

8. Find the cost of 12 A. 90 rd. of land at \$38 per acre.

9. How many square yards of paper would it take to cover the entire surface of a prism whose length is 6 ft., width 6 ft., height 8 ft.?

10. What is a rectangular prism? What is a circle?

11. If $\frac{1}{8}$ of the distance from New York to Philadelphia is 11 mi. 120 rd., what is the whole distance?

12. 6 square inches is what per cent of a six-inch square?

13. At the rate of 3 for $4\frac{1}{2}$ ¢, how many pears must I sell to receive 30¢?

LESSON 4

1. A grocer sold $87\frac{1}{2}\%$ of a barrel of vinegar and had 4 gal. left. How many gallons did he sell?

2. $\frac{1}{24}$ is what part of $\frac{1}{8}$? $\frac{1}{24}$ is what per cent of $\frac{1}{8}$?

3. What are taxes?

4. If A can do $\frac{5}{11}$ of a piece of work in a day, in what time can he do 50% of it?

5. $8\frac{1}{3}\%$ of a number is 7 less than $16\frac{2}{3}\%$ of it. What is the number?

6. What is a rhombus? What is the perimeter of a rhombus whose sides are each 3 yd. 1 ft. 8 in.?

7. What is a polygon? Rhomboid? Trapezoid?

8. How many cubic inches in a bushel?

9. Find the number of cubic feet in a bin that will hold 300 bu.

10. How many cubic inches in a gallon?

11. How many cubic inches in a quart dry measure?

12. How many cubic inches in a quart liquid measure?

13. Find the number of cubic feet in a box that will contain 50 bu.

14. Find the cost of the 2 in. planks required to floor a bridge 240 ft. long, and 20 ft. wide, at \$18 per M.

15. Mr. Johnson wishes to cover his stable, the distance from the eaves to the ridge being 14 ft., and the length 26 ft. Find the difference in cost between a tin roof at \$6 a square, and a shingle roof, at \$4.75 per thousand; allowing each shingle to cover 20 sq. in.

16. Find the number of gallons of water in a well 3 ft. in diameter and 20 ft. deep, if the well is $\frac{3}{8}$ full.

17. A cubic foot of water weighs how many ounces?

18. Find the weight of a gallon of water.

19. What is a board foot? 12 cu. ft. equal how many board feet?

LESSON 5

1. A board 16 ft. long, 1 ft. wide, and 1 in. or less thick equals how many board feet?

2. How many cubic feet of lumber equal 108 board feet?

3. How many degrees in a circumference? If the length of a circumference is 1440 ft., what is the length of a degree? Of 25° ? Of 140° ?

4. If the length of a circumference is 25,000 mi., what is the length of a degree?

5. State how to find the volume of a cylinder.
6. John spent $\frac{2}{3}$ of his money for a coat, and $\frac{1}{3}$ for books. What per cent of his money was left?
7. If 4 times $3\frac{1}{3}$ miles is $33\frac{1}{3}\%$ of the distance from Harrisburg to York, what is the distance?
8. $5\frac{1}{2}$ qt. equal what per cent of a peck?
9. A man receives \$20 a week and spends \$8. What per cent of his money does he save every month?
10. A commission merchant was paid \$27 for selling 300 barrels of flour at \$4 a barrel. Find the rate of commission.
11. I own a piece of land having the shape of a trapezoid, whose parallel sides are 25 rd. and 35 rd. respectively, and 40 rd. apart. What is the land worth at \$37 $\frac{1}{2}$ an acre?
12. How many board feet are there in a piece of timber 16 ft. long, 12 in. wide, and 10 in. thick?
13. $\frac{8}{17}$ of 1768 is 65% of what number?
14. A pile of wood contains 100 cords. It is 8 ft. wide and 8 ft. high. Find its length.

LESSON 6

1. How many cubic feet of earth must be taken out in digging a well 32 ft. deep and $6\frac{1}{2}$ ft. in diameter?
2. What will be the cost of the carpet at \$1.75 per yard, for a room 15 ft. long, and $13\frac{1}{2}$ ft. wide, if the strips run lengthwise, and the carpet is $\frac{3}{4}$ of a yard wide?
3. If 6 pears cost $10\frac{1}{5}$ cents, how much will 10 pears cost at the same rate?

4. Mr. Moore's agent bought for him 150 horses at \$75 each, at a commission of $1\frac{1}{4}\%$. How much must Mr. Moore pay?

5.

BALTIMORE, MD., Oct. 31, 1900.

Three months from date, for value received, I promise to pay Thomas Kast, or order, Three Hundred Dollars, with interest at 6%.

WILLIAM ALEXANDER.

When will this note be due?

How much must Alexander pay when the note is due? Who is the maker of this note? Who is the payee? What is the face of the note? What is the rate of interest?

6. One month's interest is what per cent of a year's interest?

7. Mr. Johnson sells bicycles, listed at \$100, at 20% and 10% off. What is the net price?

8. What is a property tax? For what purpose does a city levy taxes? What is a poll tax?

9. A merchant marked goods 25% above cost. If he sells for 25% less than his marked price, will he gain or lose, and how many per cent?

10. A's money is \$145 more than B's. How much money has each if B's is 60% of A's?

11. What per cent of 271 bu. 3 pk. 4 qt. is 150% of 3 bu. 2 pk. 4 qt.?

12. If 25 tons of coal are bought by the *long ton*, and retailed by the *short ton*, what is the gain, and what is the per cent of gain?

LESSON 7

1. A piano was sold for \$414, which was 15% more than cost. Had it been sold for \$450, what would have been the gain per cent?

2. 75 lb. equal $12\frac{1}{2}\%$ of how many hundredweight?
3. 4180 ft. equal $41\frac{2}{3}\%$ of how many miles?
4. A man paid 35% of his money for 140 A. of land. At the same rate what per cent of his money would 210 A. cost?
5. Two horses were sold for \$198 each. On one there was a gain of 10% and on the other a loss of 10%. Was there a total gain or a loss, and how much?
6. A school which has been increased 325% of its original number of pupils now numbers 1275 pupils. What was the original number?
7. Mr. Stevens sold 20 tons of hay for \$288, and thereby lost 20%. Had he sold it at \$22 $\frac{1}{2}$ a ton, what would have been the gain per cent?
8. How are shingling and slating usually estimated?
9. How many square feet equal a *square*?
10. What are the most common lengths of shingles?
11. In making estimates, carpenters usually reckon how many shingles to the square?
12. Find the cost of insuring property worth \$9000, if $\frac{3}{4}$ of the value is insured at $\frac{4}{5}\%$.
13. How many degrees of longitude equal 1 hr. of time? How many minutes of longitude equal 1 min. of time? How many seconds of longitude equal 1 sec. of time?
14. The difference in time between two places is 2 hr. 30 min. What is the difference in longitude?
15. Add 80% of a ton, 25% of a hundredweight, and $\frac{3}{4}$ of a pound. Express the answer in pounds.
16. Reduce 8 cwt. 34 lb. to the decimal of a ton.

17. What part of a pound Troy is $\frac{1}{2}$ of an ounce?
18. $\frac{1}{2}$ of an ounce equals what per cent of a pound avoirdupois weight?
19. Find the weight of 48 bu. 3 pk. 4 qt. of wheat.
20. Find how many feet board measure there are in a board 16 ft. long, 18 in. wide at one end and 14 in. at the other, and $1\frac{1}{2}$ in. thick.

LESSON 8

1. 6 bu. 3 pk. equal what per cent of $67\frac{1}{2}$ bu.?
2. Mr. Bailey sold a Singer sewing machine for \$36, which was at a gain of $33\frac{1}{3}\%$. Find the cost of the machine.
3. What per cent is gained by buying at $\$4$ and selling at $\$7$?
4. It requires 96 rd. of fence to inclose a square field. How long is each side of the field? How much is the land worth at $\$87\frac{1}{2}$ an acre?
5. What is a plane figure? A polygon of eight sides is called what?
6. What is the diameter of a circle whose circumference is 24 ft.?
7. Find the cost of 637 lb. of flour if $\frac{2}{3}$ of a barrel cost $\$3\frac{1}{2}$.
8. A man owning $\frac{5}{8}$ of a property sold $\frac{1}{4}$ of his share. What per cent of the property did he then own?
9. If 850 lb. of anthracite coal cost \$1.275, how much will $5\frac{3}{4}$ tons cost?
10. A rectangular field whose width is 40 rd. contains 12 A. Find its length.

11. A grocer bought 8 cwt. 56 lb. of sugar for \$59.92, and paid \$2.14 for freight. He wished to retail it at a gain of $\frac{1}{2}\%$ a pound. Find the selling price.

12. A man bought a building lot for \$2000. He kept it 2 yr., and then sold it at a gain of 25%. How much did he gain, allowing him 6% on the money invested?

13. My neighbor has a piece of land 45 ch. 40 li. long and 24 ch. wide. How many acres does it contain?

14. If $83\frac{1}{3}\%$ of a quantity costs \$10, what is the cost of the quantity?

15. $28\frac{7}{8}$ is $233\frac{1}{3}\%$ of what number?

16. A grocer bought cucumbers at the rate of 4 for 5 cents, and sold them at the rate of 5 for 4 cents. Find the loss on 20 cucumbers.

LESSON 9

1. An agent sold a horse at $31\frac{1}{4}\%$ advance on the cost, and gained \$46.87 $\frac{1}{2}$. Find the cost of the horse.

2. What sum must be invested in property that pays $7\frac{1}{2}\%$ profit to yield an income of \$270 a year?

3. If \$412.50 is the interest of \$1500 for 5 yr., what is the interest for 1 yr.? What is the rate per annum?

4. What is the entire surface of a square prism, whose altitude is 3 ft., and the side of whose base equals 1 ft.?

5. How many such prisms equal a cubic yard?

6. A cube, each side of which measures 1 in., is a cubic inch. A cube, each side of which measures $\frac{1}{2}$ in., is a half-inch cube. A cubic inch equals how many half-inch cubes? A two-inch cube equals how many inch cubes? How many half-inch cubes?

7. Find the cost of 1 A. 32 sq. rd. of land, at 23¢ a square yard.
8. Find the cost of $8\frac{3}{4}$ lb. of sugar at $7\frac{1}{4}$ ¢ a pound.
9. Find the cost of 35 lb. 11 oz. of butter at 30¢ a pound.
10. Find the cost of 12 lb. 9 oz. of pork at 14¢ a pound.
11. Find the cost of 3 bu. 2 pk. 4 qt. of chestnuts at 5¢ a pint.
12. Find the cost of a barrel of vinegar ($31\frac{1}{2}$ gal.) at $6\frac{1}{4}$ ¢ a quart.
13. Find the cost of 12 gal. 3 qt. 1 pt. of oil at \$.12 a gallon.
14. What is the difference in longitude between a place in $8^{\circ} 30' 40''$ east longitude, and a place in $32^{\circ} 40' 45''$ west longitude?

LESSON 10

1. I sold my buggy for \$88, which was at a loss of 12%. For how much should I have sold it to gain 30%?
2. Find the cost of 10,160 lb. of coal at \$ $3\frac{1}{4}$ a ton.
3. What is interest? Explain your method of finding the interest of \$450 for 2 yr. 3 mo. 15 da. at 6%.
4. At 25¢ a peck, how many bushels of beans can you buy for $66\frac{2}{3}\%$ of \$11.25?
5. Find the value, at \$ $31\frac{3}{4}$ an acre, of a piece of land having the shape of a triangle whose base is 50 rd. and altitude 65 rd.
6. What is an isosceles triangle? An equilateral triangle? Give rule for finding the area of a triangle when the base and altitude are given.
7. Find the value of $36\frac{3}{4}$ bu. of wheat at $1\frac{1}{4}$ ¢ a pound.

8. Robert spent $\frac{2}{3}$ of his money, then earned $\frac{1}{3}$ as much as he had left. If he then had 92¢, how much money had he at first?

9. If $\frac{3}{8}$ of a yd. of cloth cost \$1.56, how many yards will cost \$39.52?

10. How many barrels of flour can be made from the contents of a bin 10 ft. long, 5 ft. wide, and 4 ft. deep, filled with wheat, allowing 1 bu. of wheat to make 49 lb. of flour, and $1\frac{1}{4}$ cu. ft. of space to equal 1 bu.?

11. If a cubic foot of water weighs $62\frac{1}{2}$ lb., find the weight of a barrel ($31\frac{1}{2}$ gal.) of water.

12. At 10¢ a peck, how many bushels of apples can be bought for \$1.70?

13. Find the volume of a cylinder $18\frac{1}{2}$ in. in diameter and 8 in. deep. How does your answer compare with the number of cubic inches in a bushel?

14. If a vessel sails 3 leagues an hour, how many hours will it take to sail $31\frac{1}{2}$ miles?

LESSON 11

1. A dealer bought $\frac{1}{2}$ of a gross of handsaws for \$57.60. If he sells them at \$1.30 each, what per cent does he gain?

2. Find the cost of 850 ft. of boards at \$2.10 per C, and 1862 pickets at \$12.50 per M.

3. Reduce $.13\frac{1}{2}$ to a common fraction in its lowest terms.

4. Reduce 2.1875 to an improper fraction.

5. What number is that whose $\frac{1}{3}$ and $\frac{1}{4}$ together equal 14?

6. A owns $\frac{5}{8}$ of a file factory. If he sells $\frac{4}{5}$ of his share for \$1285 $\frac{1}{2}$, how much is the whole factory worth?

7. A man agreed to build a shed in 45 days. What part of it ought he to build in 24 $\frac{3}{4}$ days?

8. If a man can walk 2 mi. 120 rd. in 36 min., how far can he walk in 1 $\frac{1}{2}$ hr.?

9. In £ 6 10s. 10d. how many dollars United States currency are there?

10. At 6 $\frac{3}{4}$ ¢ each, what will be the cost of a great gross of Spencerian copy books?

11. Change 5 O. 14 f 3 3 f 3 45 m. to minims.

12. A farmer received \$.60 a bushel for 3 loads of wheat. The first load contained 52.4 bu., the second 3150 lb., and the third 42 bu. 88 lb. How much did he receive for the whole?

13. A cubic foot of distilled water weighs 1000 oz. Find the weight of 6 qt.

14. At \$3.50 a square, how much will it cost to tin both sides of a roof 50 ft. long, if the rafters are 20 $\frac{1}{2}$ ft. long?

15. At 4 o'clock, the hour and minute hands of a clock form an angle of how many degrees?

16. Change 12 A. 154 sq. rd. 2 $\frac{3}{4}$ sq. yd. to square yards.

LESSON 12

1. Mr. Richards has a rectangular piece of land containing $\frac{3}{8}$ of an acre. If its width is 120 ft. find its length.

2. How much will it cost, at 18¢ a square yard, to plaster the ceiling and sides of a room 18 ft. 6 in. long, 14 ft. wide, and 9 ft. high, no allowance being made for openings?

3. At \$30 an acre, find the value of a circular piece of land having a diameter of 12 rd.

4. How many inches in $\frac{3}{16}$ of a mile?

5. If \$67.50 is paid for insuring \$5400 on a house for 5 years, find the per cent of yearly premiums.

6. What is insurance? Premium? Policy?

7. Find the area of a sector, the radius of the circle being 10 in., and the arc of the circle 80° .

8. A horse was bought for \$80 and sold for \$86. What was the per cent of gain?

9. How many boards 16 ft. long and 3 in. wide are required to floor a room 32 ft. long and 24 ft. wide?

10. If 8 men can do a piece of work in 24 days, how many men can do it in 16 days?

11. Express $\frac{2}{5}\%$ as a decimal.

12. I sold a horse for $\frac{2}{3}$ of its cost. What per cent did I make?

13. Find the value of 50 cases of shoes, 12 pr. to the case, at \$2.85 per pair.

14. What number diminished by $5\frac{1}{2}\%$ of itself equals 408.24?

15. A lawyer collected for me 80% of a debt of \$550, and charged me $4\frac{3}{4}\%$ commission. What amount should he pay me?

16. When 30.75 bu. of wheat cost \$38.13, how much will $22\frac{1}{2}$ bu. cost?

17. After selling $33\frac{1}{3}\%$ of a piece of muslin to one person, and then $33\frac{1}{3}\%$ of the remainder to another, there were 12 yd. left. How many yards did the piece contain originally?

LESSON 13

1. How many more tons of coal can you buy for \$300, when coal is \$3 a ton, than when it has advanced $16\frac{2}{3}\%$ on that price?

2. A man can do a piece of work in $18\frac{3}{4}$ days. What per cent of it can he do in $6\frac{1}{4}$ days?

3. Find the cost of 36 pieces of wainscoting $2\frac{1}{2}$ in. wide and 18 ft. long, at \$45 per M.

4. Find the cost of 50 white pine boards, each 10 in. wide, 18 ft. long, and 1 in. thick, at \$48 per M.

5. If \$25 $\frac{1}{10}$ equals $\frac{7}{8}$ of the gain on 10 pigs, what is the average gain on each pig?

6. If \$46 $\frac{7}{8}$ is $\frac{5}{16}$ of the price I paid for a buggy, what would be the cost of 8 buggies at the same rate?

7. How many bushels of wheat will make 4650 lb. of flour, if 60 lb. of wheat make $48\frac{7}{8}$ lb. of flour?

8. If 28 bales of hay last 14 horses 12 days, how many bales will be required for 35 horses for the same time?

9. If a pole $30\frac{3}{4}$ ft. high casts a shadow $46\frac{1}{8}$ ft. long, find the length of a pole that will cast a shadow $23\frac{1}{8}$ ft. long at the same time of day.

10. If 14 men can mow a field in $8\frac{4}{7}$ days, how long will it take 10 men to mow the field?

11. A and B start from the same place and travel in the same direction. A travels at the rate of $165\frac{3}{8}$ mi. in $4\frac{3}{8}$ da., and B at the rate of $225\frac{3}{4}$ mi. in $5\frac{3}{8}$ da. How far apart will they be at the end of 18 da.?

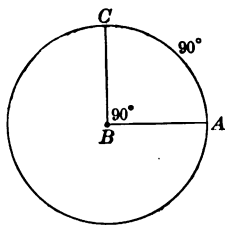
DENOMINATE NUMBERS

CIRCULAR MEASURE

LESSON 14

1. For what is *circular measure* used?
2. What is an angle? What is a *right angle*? An *acute angle*? An *obtuse angle*?
3. For the purpose of measuring angles the circumferences of circles are divided into how many equal parts? What are these equal parts called?
4. Recite the table of circular measure.

To measure an angle its vertex is made the center of a circle, and the arc included between its sides is the "size" or measure of the angle. Thus the angle ABC is measured by the arc AC . As the arc AC is $\frac{1}{4}$ of the circumference, the angle ABC is $\frac{1}{4}$ of 360° , or 90° .



5. How many degrees are there in $\frac{2}{3}$ of a right angle?
6. How many minutes are there in $\frac{2}{3}$ of a right angle?
7. How many right angles are equal to 180° ?
8. How small can an acute angle be? How large?
9. How small can an obtuse angle be? How large?
10. Is the size of an angle changed by lengthening or shortening its sides?

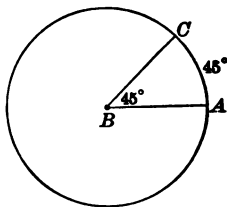
11. Does a right angle vary in size?
12. Is there any variation in the size of a degree?
13. Upon what does the size of a degree depend?
14. What is the length of a degree when the circumference measures 360 in.? 360 ft.? 360 rd.?
15. When the circumference measures 150 ft., an arc 30 ft. long equals how many degrees?
16. When the circumference measures 90 ft., an arc 15 ft. long equals how many degrees?
17. When the circumference measures 48 in., what is the length of an arc of 45° ? Of 90° ? Of 24° ?
18. How many seconds are there in $3\frac{1}{2}'$? In $5\frac{3}{8}'$? In $2' 30''$?
19. How many minutes are there in $90''$? In $420''$? In $210''$?
20. How many degrees are there in $120'$? In $240'$? In $330'$?

LESSON 15

1. Change $42,336''$ to higher denominations.
2. Reduce $28^\circ 45' 36''$ to seconds.
3. Find the sum of $36^\circ 35' 27''$, $24^\circ 45' 38''$, $12^\circ 50' 30''$.
4. From $96^\circ 32' 21''$ take $54^\circ 34' 30''$.
5. Divide $98^\circ 25' 40''$ by 15.
6. Find the length in inches of 4° when the circumference measures 60 ft.
7. Reduce $\frac{3}{4}$ C. to degrees, minutes, and seconds.
8. $128^\circ 35' 58''$ is how much less than a semicircumference?

9. What is the length of an arc of 90° of a circumference whose diameter is 10 ft.?

An angle formed by two radii of a circle contains just as many degrees as the arc between the ends of the radii. Thus, if the angle ABC is 45° , the arc AC is 45° .



Draw five circles having any convenient radii, and, with the aid of a protractor, lay off the following angles, one on each circle :

10. 30° . 11. 80° . 12. 20° . 13. 150° . 14. 75° .

With the aid of a protractor, draw two straight lines so as to form the following angles :

15. 60° . 16. 95° . 17. 170° . 18. 140° .
19. 85° . 20. 100° . 21. 175° .

22. Draw two straight lines so as to form an angle of 90° ; then extend one of the lines through the vertex, thereby forming another angle. What is the size of the second angle?

23. Draw two straight lines so as to form an angle of 60° , and then extend one of the lines through the vertex, as in Example 22, thus forming another angle. With the aid of a protractor find the size of the second angle. Find the sum of the two angles.

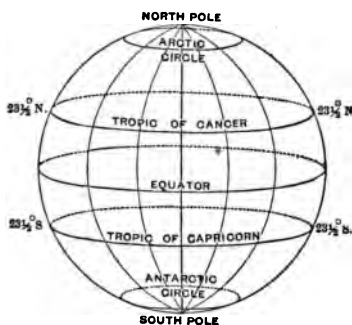
24. Draw two straight lines so as to form a right angle; then extend each line through the vertex, thereby forming three more angles. What is the size of these three angles? Find the sum of the four angles.

LATITUDE AND LONGITUDE

LESSON 16

The location of a place on the earth's surface is indicated by its latitude and longitude; that is, by stating its distance north or south of the equator, and its distance east or west of the *prime* meridian.

It is impossible to draw a straight line on the surface of a sphere, but circumferences of circles can be drawn; and the circles are of two kinds—great and small. A **Great Circle** is one that has the same diameter as the sphere itself. A **Small Circle** is one whose diameter is less than the diameter of the sphere. The equator and meridians of longitude are examples of great circles of the earth; parallels of latitude are examples of small circles of the earth.



Since the equator, parallels, and meridians are circles, we employ circular measure in computing latitude and longitude.

1. How many degrees are there in the equator? In each parallel? In each meridian circle?
2. Considering the distance around the earth to be 24,900 mi., find the length of a degree at the equator.
3. Why have all places on the equator no latitude?
4. What is the latitude of the poles? What is the latitude of a place halfway from the equator to the north pole?

5. What is the distance in degrees from the equator to the tropic of Cancer? From the equator to the tropic of Capricorn?

6. Regarding the length of a degree as equal to 69.16 mi., what is the distance in miles from the equator to the tropic of Cancer?

7. Find the width in miles of the torrid zone.

8. Find the width in miles of the north temperate zone.

9. How far apart in degrees are two places, one 23° north latitude, and the other 25° south latitude?

10. What is the distance in degrees from the equator to the arctic circle? What is the distance in miles?

LESSON 17

Longitude is measured east and west from the *prime meridian*.

1. How many degrees are there around the earth from the prime meridian? How many degrees are there in half the distance around the earth? In one fourth the distance around the earth?

The length of a degree of longitude varies with the size of the parallels of latitude, from about 69.16 statute miles at the equator, to nothing at the poles. The length of a degree of longitude, at latitude 20° , is about 65 statute miles; at 30° , about 60 mi.; at 40° , about 53 mi.; at 50° , about 44.4 mi.; at 60° , about 34.5 mi.; and at 80° , about 12 mi.

2. What is the distance in miles of 10° on the equator?

3. What is the distance in miles of 20° on parallel 30° north latitude? On parallel 30° south latitude?

4. What is the distance in degrees, minutes, and seconds, between Boston, which is $71^{\circ} 3' 58''$ west longitude, and Chicago, which is $87^{\circ} 34' 9''$ west longitude?

5. The longitude of St. Paul, Minn., is $93^{\circ} 5'$ west, and of Marseilles $5^{\circ} 22'$ east. What is the difference in longitude?

6. The latitude of New York is $40^{\circ} 42' 43''$ north, and of Rio Janeiro $22^{\circ} 54'$ south. Find the difference in latitude.

7. What is the longitude of all places on the prime meridian? Of the poles?

8. From a map or globe get the approximate latitude and longitude of Boston; New York; Philadelphia; Chicago; Denver; San Francisco; London; Paris; Quito.

9. New York is $74^{\circ} 0' 3''$, and Omaha 96° west of Greenwich. What is the difference in longitude?

10. Washington is $77^{\circ} 0' 28''$ west of Greenwich, and Boston is $71^{\circ} 3' 58''$ west. What is the difference in longitude?

11. The longitude of San Francisco is $122^{\circ} 23' 54''$ west, and of Vienna $16^{\circ} 23'$ east, of Greenwich. Find the difference in longitude.

12. The difference in longitude between St. Petersburg and St. Louis is $120^{\circ} 30' 19''$. What is the longitude of St. Petersburg, that of St. Louis being $90^{\circ} 12' 23''$ west?

13. The longitude of New York is $74^{\circ} 0' 3''$ west, and of Vienna $16^{\circ} 23'$ east. What is the difference in longitude?

14. The latitude of Baltimore is $39^{\circ} 17' 23''$ north, and of the Cape of Good Hope $34^{\circ} 22''$ south. What is the difference in latitude?

· LONGITUDE AND TIME

LESSON 18

Since the earth turns upon its axis from west to east once in 24 hr., the sun appears to revolve from east to west around the earth in the same time. Therefore a circumference (360°) is described by the apparent revolution of the sun around the earth in 24 hr.

Since the sun appears to travel through 360° of longitude in 24 hr., in 1 hr. it appears to travel through $\frac{1}{24}$ of 360° , or 15° of longitude; in 1 min. through $\frac{1}{60}$ of 15° , or $15'$; and in 1 sec. through $\frac{1}{60}$ of $15'$, or $15''$ of longitude.

15° of longitude correspond to 1 hr. of time,

$15'$ of longitude correspond to 1 min. of time,

$15''$ of longitude correspond to 1 sec. of time.

All places *east* of a certain point have *later* time, all places *west*, *earlier* time.

For example, when it is 10 o'clock A.M. at Philadelphia, it is 11 o'clock A.M. at a point 15° east of Philadelphia; 12 o'clock 30° east; 1 o'clock P.M. 45° east, etc. Again, when it is 10 o'clock A.M. at Philadelphia, it is 9 o'clock 15° west; 8 o'clock 30° west; 7 o'clock 45° west, etc.

1. People living in Philadelphia see the sun rise about 3 hr. sooner than those living in San Francisco. Why?

2. When it is noon at Cincinnati, what is the time at a point 30° east of Cincinnati? 30° west of Cincinnati?

3. When it is noon at New York, what is the time at a point 45° west of New York? 45° east of New York?

4. What places have noon at the same time?

5. When the difference in longitude between two places is 60° , what is the difference in time?

6. When the difference in longitude between two places is $7^{\circ} 30'$, what is the difference in time?

7. When it is midnight at Denver, what is the time at a point 25° west of Denver? 30° east?

8. When it is noon at Philadelphia, what time is it at a point 45° north of Philadelphia? 30° south?

9. Can you formulate a rule for finding the difference in time when the difference in longitude is given?

10. The difference in longitude between A and B is $45^{\circ} 30'$. What is the difference in time? When it is 4 P.M. at A, what time is it at B, if B is east of A?

LESSON 19

1. The difference in longitude between two places is $35^{\circ} 4'$. What is the difference in time?

Since a difference of 15° of longitude corresponds to a difference of 1 hr. in time, $15'$ of longitude to 1 min. of time, and $15''$ of longitude to 1 sec. of time, it is evident that $\frac{1}{15}$ of the difference in longitude will give a corresponding difference in time. By dividing the difference in longitude by 15, the difference in time is found to be 2 hr. 20 min. 16 sec.

$$\begin{array}{r} \text{OPERATION.} \\ 15 \overline{) 35^{\circ} 4'} \end{array}$$

2 hr. 20 min. 16 sec. *Ans.*

2. Boston is $71^{\circ} 3' 58''$, and Omaha is 96° west. Find the difference in time.

3. The longitude of New York is $74^{\circ} 3''$, and of St. Paul, Minn., $93^{\circ} 5'$ west. Find the difference in time.

4. Vienna is $16^{\circ} 23'$, and Marseilles $5^{\circ} 22'$ east. Find the difference in time.

5. The longitude of St. Petersburg is $30^{\circ} 17' 56''$ east. When it is noon at Vienna, what time is it at St. Petersburg?

6. The longitude of Paris is $2^{\circ} 20' 9''$ east. What change must a person make in his watch in going from St. Petersburg to Paris?

7. The longitude of San Francisco is about $122^{\circ} 23' 54''$ west. When it is 10.45 A.M. at Omaha, what time is it at San Francisco?

8. The difference in time between two places is 1 hr. What is the difference in longitude?

9. What is the difference in longitude when the difference in time is 2 hr.? 3 hr.? 4 hr.? 30 min.? 45 min.? $3\frac{1}{2}$ hr.?

10. Can you formulate a rule for finding the difference in longitude when the difference in time is given?

11. The difference in time between Philadelphia and St. Louis is 1 hr. 21 sec. What is the difference in longitude?

Since a difference of 1 hr. in time corresponds to a difference of 15° in longitude, 1 min. in time to $15'$ in longitude, and 1 sec. in time to $15''$ in longitude, it is evident that the difference in time multiplied by 15 will give a corresponding difference in longitude. By multiplying the difference in time by 15, we find the difference in longitude to be $15^{\circ} 5' 15''$.

hr.	min.	sec.
1	0	21
		15
		<hr/>
15°	$5'$	$15''$

12. The difference in time between two places is 1 hr. 22 min. 45 sec. What is the difference in longitude?

13. A traveler on reaching $108^{\circ} 24' 28''$ west longitude found his watch 2 hr. 5 min. 36 sec. too fast. What was the longitude of his starting point, and in what direction was he traveling?

LESSON 20

1. The difference in time between two places is 45 min. 30 sec.; the longitude of the one having the faster time is $75^{\circ} 10'$ west. What is the longitude of the other place?

2. The longitude of New York is $74^{\circ} 3''$ west. When it is 4 o'clock P.M. at New York, it is about 3.18 P.M. at Cincinnati. What is the longitude of Cincinnati?

3. The difference in time between Cape of Good Hope, longitude $18^{\circ} 28'$ east, and New Orleans is 7 hr. 13 min. 22 sec. Find the longitude of New Orleans.

4. In what direction, and through how many degrees of longitude, must a man travel in order to have his watch time $2\frac{1}{2}$ hr. too fast?

5. When it is midnight, Aug. 6, at London, longitude $5'$ west, it is 50 min. $13\frac{1}{8}$ sec. A.M. Aug. 7, at Rome. What is the longitude of Rome?

6. When it is 4.30 P.M. at Berlin, it is 52 min. $9\frac{1}{8}$ sec. past 10 A.M. at Boston, longitude $71^{\circ} 3' 58''$ west. What is the longitude of Berlin?

7. When it is 4.30 P.M. at Boston, what time is it at Berlin?

8. In going from Detroit, longitude $82^{\circ} 58'$ west, to Philadelphia, I find it necessary to set my watch forward 31 min. $15\frac{3}{8}$ sec. What is the longitude of Philadelphia?

9. Chicago is $87^{\circ} 34' 9''$ west. When it is 10.30 P.M. July 24, at Chicago, what time is it at Paris, longitude $2^{\circ} 20' 9''$ east?

10. The longitude of New Orleans is 90° west. When it is 1.30 A.M. Friday, at New Orleans, what time is it at San Francisco, longitude $122^{\circ} 23' 54''$ west?

11. Rome is $12^{\circ} 28' 26''$ east, and Washington $77^{\circ} 0' 28''$ west. What time is it at Rome when it is 7 min. $4\frac{3}{8}$ sec. past 7 o'clock P.M. July 26, at Washington?

12. When it is 1.20 P.M. at a place $84^{\circ} 30'$ west longitude, what is the time at a place $13^{\circ} 45'$ east longitude?

STANDARD TIME

LESSON 21

Standard Time is the true time of some standard meridian. It is used by nearly all railroads, cities, and towns in the United States.

NOTE. — The time considered in Lesson 19 is the true local time, and should not be confounded with the standard time of the United States.

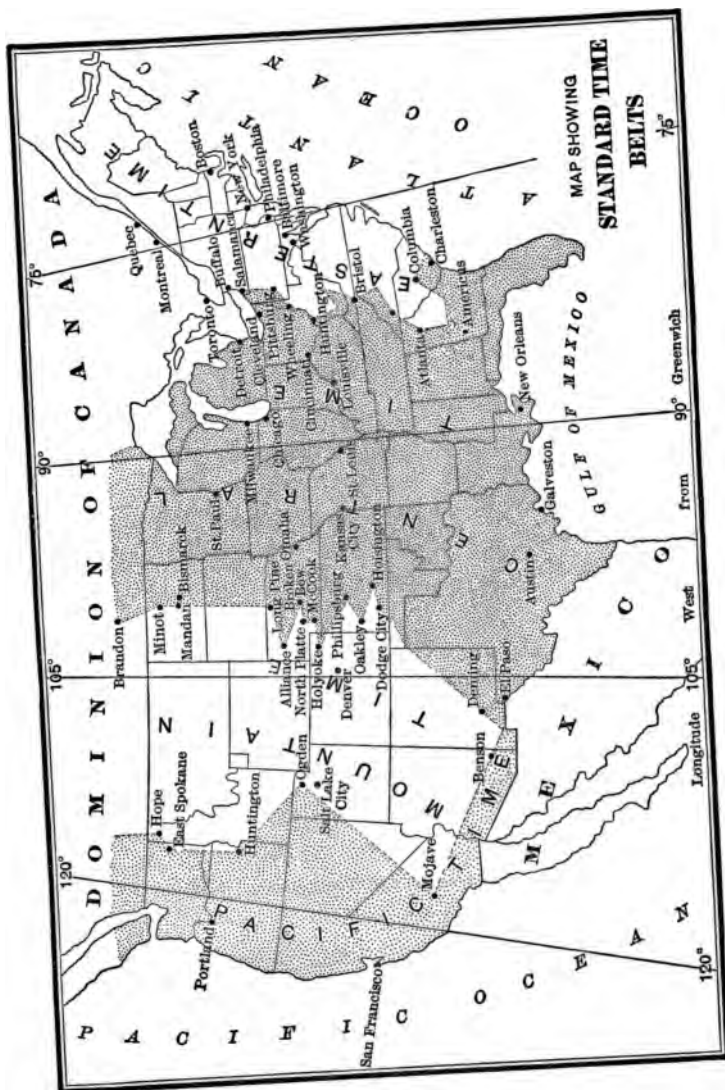
For the convenience of railroads, especially, the United States is divided by particular meridians into four sections, each 15° of longitude, known as the Eastern, Central, Mountain, and Pacific sections. The meridians selected are the 75th, 90th, 105th, and 120th west of Greenwich.

Each section extends $7\frac{1}{2}^\circ$ on each side of the standard meridian. For example, the Eastern section embraces all the territory extending $7\frac{1}{2}^\circ$ on each side of 75th meridian, the standard of this section.

The time of the Eastern section is known as **Eastern Standard Time**. It is the true local time of the 75th meridian west of Greenwich, and is 5 hr. slower than Greenwich time. All places within the Eastern section have the clock time of the meridian 75° west of Greenwich. When it is 4 o'clock P.M., for example, at longitude 75° W. it is 4 o'clock P.M. at all other places within this section.

The time of the 90th meridian is known as the **Central Standard Time**. Central standard time is 6 hr. slower than Greenwich time, and 1 hr. slower than Eastern standard time. It is the clock time of the meridian 90° west of Greenwich.

Mountain Standard Time is the clock time of the meridian of 105° west of Greenwich.



Western, or Pacific, Standard Time is the true local or clock time of the meridian 120° west from Greenwich.

NOTE. — All confusion and inconvenience arising from different local times is avoided by the standard method, for the reason that the difference of time between two places not in the same section is always one, two, or three exact hours.

1. How many degrees on each side of the 105th meridian does the Mountain section extend?

2. How many hours slower is Mountain standard time than Greenwich time? How many hours slower than Eastern standard time? How many hours slower than Central standard time?

3. How far on each side of the 120th meridian does the Pacific section extend?

4. How many hours slower is Pacific standard time than Greenwich time? Than Eastern standard time? Than Mountain standard time?

LESSON 22

NOTE. — The pupil will notice that the edges of the different time belts are very irregular. This is due to the fact that each railroad company has its own stations, where a change of time is made.

1. When it is 10 o'clock A.M. standard time in Boston, what is the standard time in Cincinnati? In Denver? In San Francisco? When it is 12 o'clock M. standard time in Denver, what is the standard time in Boston? In Cincinnati? In San Francisco?

2. Write the names of six cities that are within the Eastern section; five within the Central section; two within the Mountain section; and two within the Pacific section.

3. When it is 15 min. past 3 o'clock P.M. in Cincinnati, standard time, what is the standard time in Denver? In San Francisco? In New York?

NOTE. — Knowing the distance in degrees of any given place from its standard meridian, and the local time of that place, local time may be changed into standard time by subtracting from the local time $\frac{1}{15}$ of 1 hr., or 4 min. of time for every degree of longitude, or 1 min. of time for 15' of longitude, when the place is east of its standard meridian, or by adding to the local time 4 min. of time for every degree of longitude, or 1 min. of time for 15' of longitude when the place is west of its standard meridian.

For illustration, we shall assume that standard time coincides with local time at Philadelphia. Now, when it is 9 o'clock at Philadelphia, it is 9 o'clock at a point 5° east, and also 9 o'clock at a point 5° west of Philadelphia, according to the standard method, while in reality it is 20 min. past 9 o'clock 5° east, and 20 min. before 9 o'clock 5° west.

4. New York is about 74° west longitude. Find the difference between standard time and the actual time of that city.

5. What is the difference between the standard time and the true local time of Chicago, longitude 87° 35' west?

6. How much time must be added to the true local time of Washington, longitude 77°28' west, to express the standard time of that city?

Western, or Pacific, Standard Time is the true local or clock time of the meridian 120° west from Greenwich.

NOTE.—All confusion and inconvenience arising from different local times is avoided by the standard method, for the reason that the difference of time between two places not in the same section is always one, two, or three exact hours.

1. How many degrees on each side of the 105th meridian does the Mountain section extend?

2. How many hours slower is Mountain standard time than Greenwich time? How many hours slower than Eastern standard time? How many hours slower than Central standard time?

3. How far on each side of the 120th meridian does the Pacific section extend?

4. How many hours slower is Pacific standard time than Greenwich time? Than Eastern standard time? Than Mountain standard time?

LESSON 22

NOTE.—The pupil will notice that the edges of the different time belts are very irregular. This is due to the fact that each railroad company has its own stations, where a change of time is made.

1. When it is 10 o'clock A.M. standard time in Boston, what is the standard time in Cincinnati? In Denver? In San Francisco? When it is 12 o'clock M. standard time in Denver, what is the standard time in Boston? In Cincinnati? In San Francisco?

2. Write the names of six cities that are within the Eastern section; five within the Central section; two within the Mountain section; and two within the Pacific section.

3. When it is 15 min. past 3 o'clock P.M. in Cincinnati, standard time, what is the standard time in Denver? In San Francisco? In New York?

NOTE. — Knowing the distance in degrees of any given place from its standard meridian, and the local time of that place, local time may be changed into standard time by subtracting from the local time $\frac{1}{15}$ of 1 hr., or 4 min. of time for every degree of longitude, or 1 min. of time for 15' of longitude, when the place is east of its standard meridian, or by adding to the local time 4 min. of time for every degree of longitude, or 1 min. of time for 15' of longitude when the place is west of its standard meridian.

For illustration, we shall assume that standard time coincides with local time at Philadelphia. Now, when it is 9 o'clock at Philadelphia, it is 9 o'clock at a point 5° east, and also 9 o'clock at a point 5° west of Philadelphia, according to the standard method, while in reality it is 20 min. past 9 o'clock 5° east, and 20 min. before 9 o'clock 5° west.

4. New York is about 74° west longitude. Find the difference between standard time and the actual time of that city.

5. What is the difference between the standard time and the true local time of Chicago, longitude 87° 35' west?

6. How much time must be added to the true local time of Washington, longitude 77°28' west, to express the standard time of that city?

PRACTICAL MENSURATION

MEASUREMENT OF LAND

LESSON 23

1. State, in miles, the perimeter of a township.
2. State, in miles, the perimeter of a section.
3. How many acres in a section? In a half-section?
In a quarter-section?
4. How many acres are there in a piece of land 2 mi. long and 1 mi. wide?
5. What is the distance, in chains, around a half-section of land?
6. From a tract of land there was sold a piece 16.25 ch. long and 13.75 ch. wide. How many acres were there in the tract, if there remained 38 A. 20 sq. rd.?
7. A rectangular piece of land 57 ch. wide contains 345 A. 67.2 sq. rd. How many chains long is it?

LATHING AND PLASTERING

LESSON 24

1. What are the dimensions of plastering laths? How are they generally put up?
2. After allowing for waste, how many square yards will a bundle cover?
3. How is plastering estimated?
4. In estimating work, is it customary to make any deduction for windows, doors, etc.? Is it customary to make any allowance for openings in estimating material?

5. How many bundles of laths will be required for the walls and ceiling of a room 60 ft. long, 40 ft. wide, and 20 ft. high, deducting four doors, 3 ft. by 7 ft., and ten windows, each 10 ft. by 4 ft.?

6. What will be the cost of plastering the room described in Ex. 5, if the laths cost 25¢ a bundle, and the plastering 18¢ a square yard, making no allowance for windows and doors in plastering?

7. Find the cost of lathing and plastering the walls and ceiling of a room 45 ft. long, 27 ft. wide, and 18 ft. high, if the laths cost 22¢ a bundle, and the plastering 18¢ a square yard. Make no allowance for plastering, but deduct 200 sq. ft. in estimating for lathing.

PAINTING AND PAPERING

LESSON 25

1. How is painting usually estimated?
2. The wall paper commonly used is how wide?
3. How is it put up? How many square feet in a single roll? In a double roll?
4. Find the approximate number of double rolls of paper required for a room 12 ft. by 16 ft., and 9 ft. high, with two windows 3 ft. by 6 ft., and one door 4 ft. by 8 ft.

OPERATION

$$(16 \times 2) + (12 \times 2) \times 9 = 504 \text{ sq. ft. in walls.}$$

$$16 \times 12 = 192 \text{ sq. ft. in ceiling.}$$

$$504 \text{ sq. ft.} + 192 \text{ sq. ft.} = 696 \text{ sq. ft. in walls and ceiling.}$$

$$(3 \times 6 \times 2) + (8 \times 4) = 68 \text{ sq. ft. in windows and door.}$$

$$696 \text{ sq. ft.} - 68 \text{ sq. ft.} = 628 \text{ sq. ft. to be covered.}$$

$$48 \times 1\frac{1}{2} = 72 \text{ sq. ft. in a double roll.}$$

$$628 \div 72 = 8\frac{1}{3}, \text{ or } 9 \text{ double rolls. } Ans.$$

5. How much will it cost to paint the walls and ceiling of a schoolroom 38 ft. long, 30 ft. wide, and 14 ft. high, at 5¢ a square yard, deducting 20 sq. yd. for openings?

6. How many double rolls of paper would be required for the walls and ceiling of a room 60 ft. long, 40 ft. wide, and 16 ft. high, deducting 4 doors 12 ft. by 6 ft., and 8 windows each 10 ft. by 4 ft.?

7. Find the entire cost of papering the following rooms, at 60¢ a double roll, bordering 10¢ a yard:

a. 16 ft. by 18 ft., and 9 ft. high.

b. 12 ft. 8 in. by 14 ft., and 9 ft. high.

c. 14 ft. 6 in. by 16 ft. 9 in. and 9 ft. high.

d. 13 ft. 9 in. by 15 ft. 4 in., and 9 ft. high.

In each room there are 3 windows, each 4 ft. by 8 ft., and 1 door, 2 ft. 8 in. by 6 ft. 8 in. No allowance is made for bordering.

CARPETING

LESSON 26

1. How is carpeting sold? What is the width of Brussels carpet? Of ingrain carpet?

2. How many yards of carpet 27 in. wide will be required to cover the floor of a room 27 ft. long, 20 ft. wide, the strips to run lengthwise?

OPERATION

27 in. = $2\frac{1}{4}$ ft., width of carpet in feet.

20 ft. \div $2\frac{1}{4}$ ft. = 8 + ; \therefore 9 = number strips needed.

27 ft. = 9 yd., length of 1 strip.

9 yd. \times 9 = 81 yd. *Ans.*

3. A room is 17 ft. 6 in. by 20 ft. Find the total cost of carpeting it with Brussels carpet, at \$1.40 per yard, surrounded by a border 2 ft. wide, mitered at the corners, at \$1.25 a yard. The strips are to run crosswise.

4. Find the entire cost of carpeting the following rooms:
 - a. 25 ft. 9 in. long by $18\frac{3}{4}$ ft. wide, with Brussels.
 - b. 12 ft. 8 in. long by 9 ft. wide, with ingrain.
 - c. 18 ft. 4 in. long by 15 ft. wide, with ingrain.
 - d. 27 ft. 9 in. long by 21 ft. wide, with Brussels.

The strips are to run the way of the rooms that will not require any to be turned under. The carpet of the *first* and *fourth* rooms is to be surrounded by a carpet border 18 in. wide, mitered at the corners. The cost per yard of the Brussels is \$1.40 ; ingrain, \$.85 ; the border, \$.85.

WOOD AND LUMBER

LESSON 27

1. What is *cord wood*? How is a cord of wood usually represented?

2. How many cubic feet equal a cord? What is a *cord foot*?

3. What is a *board foot*? A cubic foot equals how many board feet?

4. How do you change cubic feet to board feet? Board feet to cubic feet?

5. Find the number of board feet in a board 15 ft. long and 16 in. wide.

By the first method we change the width, 16 in., to its equivalent, $1\frac{1}{3}$ ft., and then multiply the length by the width, and obtain 20, the number of board feet in the board.

OPERATION I

$$16 \div 12 = 1\frac{1}{3} \text{ ft.} = \text{width of board.}$$

$$1\frac{1}{3} \times 15 = 20, \text{ board feet.} \quad \text{Ans.}$$

OPERATION II

$$(16 \times 15) \div 12 = 20, \text{ board feet.} \quad \text{Ans.}$$

By the second method we multiply the length in feet by the number expressing the width in inches, and divide the product obtained by 12. This method, which is practically the same as the first, is the one generally used.

6. Find the contents of a board 16 ft. long and 15 in. wide.

7. How many board feet are there in 25 planks 18 ft. long, 16 in. wide, and $1\frac{1}{2}$ in. thick?

8. How many board feet are there in a joist 8 in. by $2\frac{1}{2}$ in., and 16 ft. long?

A joist $2\frac{1}{2}$ in. thick and 8 in. wide is equal to a board 1 in. thick and $2\frac{1}{2}$ times 8 in., or 20 in., wide. Hence square lumber may be expressed in board feet by multiplying the length in feet by the width and thickness in inches, and dividing the product by 12, as shown in the operation.

OPERATION

$$(2\frac{1}{2} \times 8 \times 16) \div 12 = 26\frac{2}{3}. \text{ Ans.}$$

How many board feet are there in :

9. 24 joists, $3\frac{1}{2}$ in. by 8 in., and 18 ft. long?
10. 2 pieces of squared timber, 7 in. by 7 in., and 14 ft. long?
11. 3 girders, 10 in. by 16 in., and 32 ft. long?
12. 48 rafters, 3 in. by 8 in., and 18 ft. long?
13. How many cords of wood are there in a pile 12 ft. long, 6 ft. high, and 4 ft. wide?
14. A pile of wood 240 ft. long and 8 ft. wide contains 90 cords. Find the height of the pile.
15. A shed 12 ft. wide and 16 ft. high contains 475 cords of tan bark. Find the length of the shed.

MASONRY

LESSON 28

1. How is *stonework* generally estimated?
2. Describe a *perch* of stone or of masonry.
3. How do masons measure walls in estimating labor? In estimating materials?

4. How many perches of masonry are there in the foundation walls of a house 50 ft. long, 30 ft. wide, with a center wall running lengthwise, if the walls are 6 ft. high and $2\frac{1}{2}$ ft. thick? (Use outside measurements.)

NOTE. — A load of sand and 3 bu. of lime will lay about 4 perches of wall. Stone masons reckon a fractional part of a perch as a whole one.

5. How much will the stone, lime, and sand cost for a wall 42 ft. long, 6 ft. high, and $2\frac{1}{2}$ ft. thick, if the stone costs \$1.20 a perch, the sand 50¢ a load, and the lime 25¢ a bushel, allowing a perch of stone to make 21 cu. ft. of wall?

6. How much will it cost, at 75¢ a perch, to lay the foundation walls of a house 48 ft. long, 25 ft. wide, and 8 ft. high, with a center wall running crosswise, if the outside walls are $2\frac{1}{2}$ ft. thick, and the center wall 2 ft. thick? (Use outside measurements.)

7. Find the cost of the materials required for the walls described in the preceding example, if the stone costs \$1.80 a perch, the lime 30¢ a bushel, and the sand 90¢ a load. Allow 21 cu. ft. of wall to 1 perch of stone.

8. How is brickwork usually estimated?

9. In making estimates, how many bricks are reckoned to the cubic foot?

NOTE. — Bricklayers, like stone masons, use outside measurements in estimating labor, and make no deductions for doors, windows, and corners unless otherwise specified by contract. In estimating materials, allowance is made for openings.

10. How many bricks will be required to build a wall 45 ft. long and 6 ft. high, the wall being 2 bricks, or 9 in., thick? (Allow 15 bricks to 1 sq. ft. of wall.)

11. I intend to build a two-story brick house 48 ft. long and 30 ft. wide. How many bricks will be required to build the walls of the first story 12 ft. high, and 3 bricks, or 13 in., thick? Deduct 8 windows, 8 ft. by 4 ft., and 2 doors, 8 ft. 10 in. by 4 ft. (Allow 21 bricks for 1 sq. ft. of wall, and count corners but once.)

12. How many bricks will be required to build the walls of the second story in Ex. 11, 10 ft. high, and 2 bricks, or 9 in., thick? Allow for 8 windows, 8 ft. by 4 ft. (Reckon 15 bricks to 1 sq. ft. of wall, and count corners but once.)

ROOFING

LESSON 29

1. How are shingling and slating usually estimated? How is tinning reckoned?

2. Shingles are considered to average how many inches in width? How many inches to the weather are they generally laid?

3. If laid 4 in. to the weather, how many square inches will 1 shingle cover? How many square feet will 1 bunch cover? 4 bunches, or 1000 shingles?

4. If laid $4\frac{1}{2}$ in. to the weather, how many square inches will 1 shingle cover? 1 bunch? 4 bunches, or 1000 shingles?

NOTE.—In making estimates, carpenters ordinarily reckon 1000 shingles to the square.

5. Find the cost of the shingles required to cover a double roof 50 ft. long, the length of the rafters being 24 ft., at \$1.75 a bunch, if the shingles are laid 4 in. to the weather.

6. Find the cost of tinning a porch roof 36 ft. 8 in. long and 7 ft. wide, at $12\frac{1}{2}$ ¢ a square foot.

7. Find the cost of slating a roof 40 ft. 8 in. long at \$12.50 a square, if each side of the roof is 20 ft. long.

8. Find the exact number of shingles required to lay a double roof 36 ft. long, the distance from the eaves to the ridge being 18 ft., if the shingles are laid 5 in. to the weather, and the first course along the eaves doubled. (Each shingle to average 4 in. in width.)

9. Mr. Johnson wishes to cover his stable, the distance from the eaves to the ridge being 15 ft., and the length 30 ft. Find the difference in cost between a tin roof at \$5 a square and a shingle roof at \$4.75 per thousand, allowing each shingle to cover 20 sq. in.

CAPACITY OF BINS

LESSON 30

1. How many cubic inches are there in a bushel?

2. A bushel equals about how many cubic feet?

3. Find the exact number of bushels contained in a bin 8 ft. long, 5 ft. wide, and 6 ft. deep. Find the approximate number of bushels.

$(8 \times 5 \times 6 \times 1728) \div 2150.42 = \text{exact number of bushels. Explain.}$

$(8 \times 5 \times 6) \div 1\frac{1}{4} = \text{approximate number of bushels. Explain.}$

4. Find the exact number of bushels contained in a bin 10 ft. by 8 ft. by 6 ft. Find also the approximate result.

5. Find the number of cubic feet in a bin that will hold 80 bu.

$(2150.42 \times 80) \div 1728 = \text{exact result. Explain.}$

$(80 \times 1\frac{1}{4}) = \text{approximate result. Explain.}$

6. Find the exact number of cubic feet of space occupied by 400 bu. of wheat. Find also the approximate number.

There are 2747.7 cu. in. in a heaped bushel. Hence a heaped bu. equals about 1.6 cu. ft. ($2747.7 \div 1728 = 1.59+$ cu. ft.).

7. How many bushels of apples will a box hold that is 6 ft. square and 4 ft. deep? Find also the approximate result.

$$(6 \times 6 \times 4 \times 1728) \div 2747.7 = \text{exact number bushels. Explain.}$$

$$(6 \times 6 \times 4) \div 1.6 = \text{approximate result. Explain.}$$

8. How many bushels of potatoes will a bin hold that is 12 ft. long, 8 ft. wide, and 6 ft. deep? Find also the approximate result.

9. Find the number of cubic feet in a bin that will hold 75 bu. of parsnips.

$$(2747.7 \times 75) \div 1728 = \text{exact result. Explain.}$$

$$75 \times 1.6 = \text{approximate result. Explain.}$$

10. Find the number of cubic feet of space required to hold 125 bu. of onions. Find also the approximate result.

11. Find the difference between the exact and approximate number of cubic feet of space required to contain 385 bu. of corn in the ear.

12. Find the approximate number of bushels of potatoes that can be put into a box 4 ft. long, 3 ft. wide, and $3\frac{1}{2}$ ft. deep.

CAPACITY OF CISTERNS, ETC.

LESSON 31

1. How many cubic inches are there in a gallon?

2. A gallon equals what part of a cubic foot? $231 \div 1728 = ?$

3. Find the number of gallons of water contained in a tank 8 ft. long, 6 ft. wide, and 5 ft. deep.

$$(8 \times 6 \times 5 \times 1728) \div 231 = \text{exact result. Explain.}$$

$$(8 \times 6 \times 5) \div .1336 = \text{approximate result. Explain.}$$

4. How many gallons of water will a cistern 6 ft. square and 8 ft. deep hold? Find also approximate result.

5. From a rectangular cistern 10 ft. long, 8 ft. wide, and 6 ft. deep, 100 barrels of water were drawn. How many gallons remained in the cistern, if it was full at first?

6. Find the approximate number of gallons of water in a reservoir 500 ft. in diameter and 10 ft. deep.

7. How many cubic feet of space will be required to contain 450 gal?

$$(450 \times 231) \div 1728 = \text{exact result. Explain.}$$

$$450 \times .1336 = \text{approximate result. Explain.}$$

8. How many cubic feet of space will be required to hold 50 bbl.? Find also approximate result.

NOTE. — To find the approximate number of barrels a cistern will hold, divide the contents expressed in cubic feet by 4.21, the number of cubic feet, nearly, in a barrel.

9. How many barrels will a cistern hold that is 10 ft. long, 8 ft. wide, and 12 ft. deep?

$$(10 \times 8 \times 12) \div 4.21 = \text{answer. Explain.}$$

10. Find the approximate number of barrels in a cylindrical cistern 8 ft. in diameter and 10 ft. deep.

11. Find the approximate number of barrels that will be contained in a tank 6 ft. 6 in. square and 8 ft. deep.

REVIEW WORK

LESSON 32

1. At $12\frac{1}{2}$ ¢ a square yard, how much will it cost to sod a piece of ground $82\frac{1}{2}$ ft. by 132 ft.?

2. Find the cost of 36 joists 18 ft. long, 12 in. wide, and $2\frac{1}{2}$ in. thick, at \$1.30 per hundred feet, board measure.

3. $\frac{3}{5}$ of a certain number is greater by 90 than 50% of it. What is the number?

4. If .4 of a barrel of sugar is worth \$7.60, how much must be paid for $3\frac{1}{2}$ barrels?

5. If $\frac{3}{8}$ of a yard of silk is worth \$1.20, how many yards will cost \$31.20?

6. Find the number of square feet in the sides and bottom of a cistern 10 ft. square and $8\frac{1}{2}$ ft. deep.

7. If $16\frac{2}{3}$ tons of coal cost \$100, how much will $18\frac{3}{4}$ tons cost?

8. $\frac{7}{12}$ of $\frac{4}{7}$ of $\frac{3}{8}$ of a pound of sugar equals how many ounces?

9. $\frac{7}{8}$ of $\frac{5}{8}$ of $1\frac{1}{8}$ of a ton equals how many pounds?

10. $\frac{5}{12}$ of a quantity is how many hundredths of the quantity?

11. $\frac{1}{6}$ of a number is 26 less than $.41\frac{2}{3}$ of it. What is the number?

12. Oranges were bought at the rate of 4 for 10¢ and sold at 3¢ apiece. What was the per cent of gain?

13. What is the ratio of $16\frac{2}{3}$ to $66\frac{2}{3}$? To $83\frac{1}{3}$?

14. What is the antecedent? Consequent? Ratio?
15. The antecedent is $\frac{3}{4}$; the consequent, $\frac{3}{8}$. What is the ratio?
16. The consequent is $\frac{2}{5}$; the ratio, $\frac{5}{8}$. What is the antecedent?
17. At 10¢ a peck, how many apples can be bought for \$16.40?
18. What part of a circumference is an arc of $22\frac{1}{2}^\circ$?
19. What time is it at Denver when it is half-past 2 o'clock P.M. 15° east of Denver? $7\frac{1}{2}^\circ$ east?
20. According to the census of 1900 a town had 7872 inhabitants, which is 36% less than the number it had in 1890. Find the number of inhabitants of the town in 1890.

LESSON 33

1. A farmer sold $\frac{1}{5}$ of his potatoes to one man, $66\frac{2}{3}\%$ to another, and had 36 bu. left. How many bushels had he at first?
2. 8 is 80% of what number? $\frac{1}{4}$ is what part of $\frac{1}{2}$?
3. What is $\frac{1}{2}\%$ of \$50? $\frac{3}{4}\%$ of \$100? $1\frac{1}{4}\%$ of \$80?
4. A man bought a farm 10 yr. ago for \$1200. If it has increased in value 200%, what is its present value?
5. How many bushels of wheat at 80¢ a bushel will pay for $2\frac{1}{2}$ tons of coal at \$6.40 a ton?
6. If a quantity of butter lasts 4 persons $6\frac{1}{4}$ mo., how long will it last 5 persons?
7. If \$9.96 was paid for 31 gal. 1 pt. of sirup, what was the price per gallon?
8. If 12 men in $8\frac{1}{2}$ da. earn \$280.50, at the same rate how much will 1 man earn in 3 da.?

9. If it requires $\frac{3}{4}$ of a pound of flour to make a 5-cent loaf of bread, how many loaves can be made from a barrel of flour? If the cost of the flour is \$5.75, what is the gain per barrel?

10. A field 8.25 ch. wide contains 8 A. 7 P. Find its length.

11. What will be the cost of the carpet for a stair of 22 steps 10 in. wide, each rising 8 in., at 75¢ a yard, allowing 22 in. extra for projection of steps?

12. If 12 men can do a piece of work in $9\frac{1}{4}$ days, how many days will 15 men require to do an equivalent piece of work?

13. What is the ratio of the area of a piece of land 72 rd. long and 40 rd. wide to that of another field one half as long and one half as wide?

14. The radius of a circle is 4 ft.; the circumference is 25.1328 ft. What is the ratio of the circumference to the diameter?

15. The antecedent is $8\frac{3}{4}$; the ratio, $9\frac{1}{2}$. What is the consequent?

LESSON 34

1. The sum of two numbers is $4\frac{2}{3}$, and their difference is $\frac{3}{8}$. What are the numbers?

2. What is the ratio of 4 hr. 20 min. to 3 hr. 15 min.?

3. A door is 2 ft. 8 in. by 6 ft. 8 in. What is the ratio of the height to the width?

4. A floor 22 ft. by $24\frac{1}{2}$ ft. is to be covered with Brussels carpet, surrounded by a border 2 ft. wide, the strips of carpet to run lengthwise. What will be the cost, if the carpet is worth \$1.35 and the border $87\frac{1}{2}$ ¢ a yard?

5. The difference in time between two places is 2 hr. 15 min. The longitude of the western place is 75° W. What is the longitude of the eastern place?

Simplify:

$$6. \frac{30 \times 7\frac{1}{2} \times 18}{22\frac{1}{2} \times 45} \quad 7. \frac{52\frac{1}{2} \times 50}{21 \times 7\frac{1}{2} \times 37\frac{1}{2}} \quad 8. \frac{37\frac{1}{2} \times 22\frac{1}{2} \times 12}{75 \times 45 \times 9}.$$

9. Give the rule for reducing a common fraction to a decimal. Illustrate the rule by an example.

10. Explain why a leap year contains 366 da.

11. A horse was sold for \$196, which was at a loss of 2%. Find the cost of the horse.

12. What number diminished by 75% of itself leaves $36\frac{3}{8}$?

13. It will require 1200 ft. of siding for a house if it is put on 4 in. to the weather. How much less will it require if it is laid 5 in. to the weather?

14. A man owning 80% of $156\frac{2}{3}$ acres of land, sold $\frac{1}{2}$ of $\frac{3}{4}$ of it. How many acres did he sell?

15. Find the cost of 80% of $6\frac{1}{2}$ tons of coal at $\frac{2}{3}$ of \$ $5\frac{1}{4}$ a ton.

16. A man owning $\frac{5}{8}$ of a door factory, sold 80% of his share for \$2570 $\frac{2}{3}$. How much was the whole factory worth?

17. A man lost 20% of his money in business, and used $\frac{1}{3}$ of the remainder to maintain his family, after which he had left \$80. How much had he at first?

LESSON 35

1. Find the number of posts required for a fence around a piece of ground 875 ft. by 910 ft., if the posts are to be set 7 ft. apart.

2. Find the number of 2×4 scantlings 14 ft. long that will be required for stringers in Ex. 1, one stringer being placed at the bottom and one at the top.

3. Find the number of boards 12 in. wide and 14 ft. long that will be required for the base in Ex. 1.

4. Find the number of 3-in. pales, placed 2 in. apart, that will be required in Ex. 1.

5. Find the cost of the material required for the fence in Ex. 1, if the posts are worth \$10 per hundred, the 2×4 scantlings \$11 per thousand feet, the base boards \$14 per thousand feet, and the pales \$30 per thousand.

6. Allowing ice to weigh 56 lb. to the cubic foot, how many tons of ice can be stored in an icehouse 100 ft. long, 20 ft. wide, and 10 ft. high?

7. A man, after drawing 20% of his money out of bank, found that he had \$512.80 left. How much had he in the bank at first?

8. If $\frac{5}{8}$ of $\frac{7}{9}$ of a farm cost \$7000, what is $\frac{8}{11}$ of it worth?

9. How many pieces of cloth, each containing $2\frac{3}{4}$ yd., can be cut from a piece containing $100\frac{1}{2}$ yd.?

10. At \$6.86 a barrel, how much will 90 lb. of flour cost?

11. A man bought 56 acres of land at \$25 $\frac{3}{4}$ an acre; he paid \$230 for taxes, fencing, etc., and sold it for 40% more than the cost. Find his whole gain, and how much per acre he received for it.

12. If $7\frac{3}{4}$ tons of hay last 6 horses 3 mo., how many tons will last 9 horses the same time?

13. If a man earns \$3 $\frac{2}{7}$ in 4 da., how many dollars will he earn in 21 da.?

14. B's horse cost \$120, and $\frac{4}{5}$ of its cost is $\frac{1}{5}$ of 2 times the cost of his carriage. Find the price of the carriage.

LESSON 36

1. Change £ 9 12 s. 6 d. to United States money.
2. Find how much is gained by a druggist who buys 10 lb. of drugs, avoirdupois weight, at \$ 2.70 per pound, and sells it at 20¢ per dram, apothecaries' weight.
3. How many cubic inches are there in a dry quart? In a liquid quart?
4. A man started on a pleasure trip Sept. 1, 1900, and returned April 1, 1901. How many days was he gone?
5. The distance from A to B is 16 miles, and $\frac{3}{4}$ of this distance is $\frac{2}{3}$ of $\frac{1}{6}$ of the distance from A to C. What is the distance to C?
6. M is 56 miles from N, and $\frac{5}{7}$ of this distance is $1\frac{3}{5}$ times $\frac{1}{10}$ of the distance from N to P. What is the distance to P?
7. How many sheets are there in 3 bundles, 1 ream, 15 quires, 10 sheets?
8. Divide 41 bu. 1 pk. 7 qt. 1 pt. by 9.
9. Find the area of a circle whose diameter is 20 rd.
10. Find the area of a triangle whose base is $9\frac{1}{4}$ ft. and altitude $12\frac{3}{4}$ ft.
11. Mr. A's house is insured for \$2800, and $\frac{7}{4}$ of this sum is $3\frac{1}{3}$ times $\frac{1}{2}$ of the insurance on his furniture. Find the amount of insurance on the furniture.
12. If by selling 1 orange I gain $\frac{3}{20}$ of a cent, how many oranges, at this rate, must I sell to gain $14\frac{2}{5}$ ¢?
13. Reduce .075 and .0125 to common fractions.
14. How many posts, at \$ 9.50 per C., will cost \$138.70?
15. Divide .00168 by .96. $427 \div .05 = ?$
16. Change $\frac{3}{7}$, $\frac{4}{8}$, and $\frac{3}{7}$ to ninetieths.
17. 72 ft. equal how many fathoms?

PERCENTAGE

LESSON 37

Percentage is the process of computing by hundredths. The principal quantities considered in percentage are the base, the rate, the percentage, the amount, and the difference.

The **Base** is the number on which the percentage is computed.

The **Rate** is the number which denotes how many hundredths of the base are to be taken.

The **Percentage** is the result obtained by multiplying the base by the rate expressed as a decimal.

The **Amount** is the sum of the base and the percentage.

The **Difference** equals the base minus the percentage.

Formulate a rule :

1. To find the percentage, when the base and rate are given.
2. To find the rate, when the base and percentage are given.
3. To find the base, when the percentage and rate are given.
4. Make and solve a problem to illustrate Rule 1. Rule 2. Rule 3.
5. Define base; rate; percentage; amount; difference.

Complete the following table :

	Base	Rate	Percentage	Amount	Difference
6.	750	8%	?	?	?
7.	\$1400	?	\$175	?	
8.	?	66 $\frac{2}{3}$ %	\$563.73 $\frac{1}{3}$?
9.		?	\$116	\$1566	
10.	130 lb.	?	19.5 lb.		
11.	?	?	\$33.60	?	\$606.40
12.	385 ft.	?	161.7 ft.		
13.	$\frac{25}{8}$	32%	?	?	?
14.	$\frac{35}{64}$?	$\frac{7}{8}$?	?
15.	184 qt.	?	51 $\frac{3}{4}$ gal.	?	?
16.	?	49.6%	353.4	?	?

LESSON 38

1. Mr. Koons failed in business, and paid only 35% of his debts. How much did Mr. Riley lose if Koons owed him \$1875?

2. A man owning $\frac{3}{8}$ of a mill, valued at \$1000, sold his share for 20% more than its value. How much did he receive?

3. For how much must I rent my farm of 125 acres, worth \$70 an acre, to realize an annual income of 8% from it?

4. A man's annual income is \$3200. If he pays 25% of it for rent, and 33 $\frac{1}{3}$ % of it for other expenses, how much can he save in 5 yr.?

5. A laborer agreed to dig a mill race $\frac{1}{2}$ mi. long, 4 ft. deep, and 8 ft. wide, at 30¢ a cubic yard. He lost 6% on the contract price. Find his loss.

6. A coal dealer bought 160 tons of coal for \$600. After allowing 10% for waste, he retailed the remainder so as to realize 20% on his investment. Find the retail price per ton.

7. A grain dealer bought 8640 bu. of wheat at \$1.10 per bushel, and sold 25% of it at \$1.12 $\frac{1}{2}$, and 40% at \$1.25, and the remainder at 95¢. How much more did he receive for it than he paid?

8. A farmer raised 960 bu. of buckwheat. He sold 8 $\frac{1}{3}$ % of it to one man, 12 $\frac{1}{2}$ % to another, and had 16 $\frac{2}{3}$ % made into flour. How many bushels were left? What he sold to the first man is how many per cent of what he had left? What he sold to the first man is how many per cent of what he sold to the second man?

9. A pole 32 $\frac{1}{2}$ ft. high casts a shadow 13 ft. long. The length of the shadow is what per cent of the height of the pole? Another pole, at the same time of day, casts a shadow 19 $\frac{1}{2}$ ft. long. The height of the second pole is how many per cent of the height of the first pole?

10. Two brothers, John and William, each bought a farm. William's farm contained 120 acres, and John's contained 12 $\frac{1}{2}$ % more acres than William's. William paid \$30 an acre, and John paid 16 $\frac{2}{3}$ % less per acre than William. How much more did William pay for his farm than John?

11. Mr. Johnson received \$4300 from his father's estate. He invested 35% of it in railroad stock, 40% in bonds, and the remainder in real estate. Find his annual income from each if he realizes 8 $\frac{3}{4}$ % on the railroad stock, 5% on the bonds, and 5 $\frac{1}{2}$ % on the real estate.

12. $42\frac{1}{2}\%$ of \$8400 is 40% less than a man paid for 100 acres of farm land. How much per acre did he pay?

13. 81 mi. 120 rd. equals $12\frac{1}{2}\%$ less than the distance from New York to Philadelphia. What is the entire distance?

LESSON 39

1. 32 mi. 122 rd. 12 ft. equal $11\frac{1}{3}\%$ less than what distance?

2. Goods to the value of \$2043 were destroyed by water. The insurance was \$1634.40. The insurance was what per cent of the value of the goods?

3. What per cent of 18 hr. 30 min. is 3 hr. 42 min.?

4. A speculator bought 760 tons of tan bark, and was forced to sell it for 8% less than he paid for it. Find the cost per ton if he received \$15,382.40 for it.

5. An importer failed in business. His property was valued at \$7677.45. What per cent can he pay if he owes \$12,690?

6. What number increased by 3.5% of itself equals 414?

7. From a barrel containing 30 gal. of cider, $11\frac{1}{4}$ gal. leaked out. What per cent remained?

8. A farmer raised $37\frac{1}{2}$ bu. of potatoes from $2\frac{1}{2}$ bu. of seed. What was the per cent of increase?

9. A laborer dug potatoes for 10% of them. He sold his share at 75¢ a bushel, and received \$57. How many bushels did he dig?

10. What per cent would a grocer gain by giving 15 oz. of sugar to his customer instead of a pound?

11. A merchant sold cloth for \$135.45, thereby losing 10%. What would have been the selling price had he gained \$13.25?

12. A farmer, having sent 1200 bu. of potatoes to market, found that $2\frac{3}{4}\%$ of them had decayed. If he sold the remainder at $62\frac{1}{2}\%$ a bushel, how much did he receive for his potatoes?

13. How many gallons of water must I mix with $35\frac{1}{2}$ gal. of vinegar so that the mixture may contain 6% of water?

14. A dealer asked 20% more for shingles than cost, but was afterward obliged to sell them for 90% of his asking price. If he received \$7.29 a thousand, what was the cost?

15. A, B, and C divided a certain number of bushels of grain among themselves. A received $42\frac{1}{2}\%$, B $35\frac{1}{4}\%$, and C the remainder. How many bushels were divided if C received 87 bu.?

16. A school which has been increased 325% of its original number of pupils now numbers 1275 pupils. What was the original number?

17. Cord wood was sold so that 60% of the selling price equaled $85\frac{1}{4}\%$ of the cost. What was the gain per cent?

COMMISSION

LESSON 40

A **Commission Merchant** is a person who buys and sells merchandise for another.

An **Agent** is a person authorized to transact business for another. He buys, sells, and rents property ; collects money, lends money, etc.

Commission is a percentage charged by commission merchants and agents for transacting business. It is reckoned on the amount invested, sold, or collected.

The **Net Proceeds** is the sum left after the commission and other expenses have been deducted.

The **Amount** is the sum of the base, commission, and other charges.

How do you find :

1. The *commission*, when the base and rate are given ?
2. The *rate*, when the base and commission are given ?
3. The *base*, when the commission and rate are given ?

Complete the following table :

	Base	Rate	Commission	Net Proceeds	Amount
4.	\$ 960	$5\frac{1}{2}\%$?	?	
5.	\$ 320	?	\$ 15.20		?
6.	\$ 36.80	?	?		\$ 38.64
7.	?	4%	\$ 3.70	?	
8.	?	?	\$ 11.40	\$ 178.60	
9.	?	$8\frac{1}{5}\%$?		\$ 703.30
10.	?	4%	?	\$ 720	
11.	\$ 560	?	?		\$ 588

12. A commission merchant sold a consignment of potatoes for \$810. What was his commission at $3\frac{2}{3}\%$?

13. A real estate agent sold a piece of land for \$12,500, charging $3\frac{1}{2}\%$. Find his commission.

14. A flour dealer sold 430 barrels of flour at \$5.75 a barrel, receiving a commission of $2\frac{1}{2}\%$. Find the amount paid over to the consignor.

15. An agent collected 80% of a debt of \$7360. What was his commission at $4\frac{1}{2}\%$, and how much did he pay over to his employer?

16. A commission of \$308 was charged by a commission merchant for selling apples, his rate being $3\frac{1}{2}\%$. Find the amount of the sales.

17. An agent charged me \$126.94 $\frac{1}{2}$ for collecting for me. Find the amount of his collections, his rate of commission being 5%.

18. A Boston commission merchant sold a consignment of beef for a Chicago dealer, and remitted \$880.65 proceeds to the consignor. The rate of commission being 5%, how much did the beef bring?

LESSON 41

1. A western dealer shipped 640 head of cattle to Baltimore to be sold on a commission of 8%. The sale netted him \$26,496. Find the average selling price per head.

2. Mr. Phillips collected a claim for me, charging 10% commission. If he paid me \$477.54, find the amount of the claim.

3. I paid an agent \$82.80 for collecting a claim of \$1440. What was the rate of commission?

4. If \$31½ is charged for collecting \$1260, what is the rate?

5. When \$62.40 commission is paid for selling \$1920 worth of corn, what is the rate?

6. An agent bought 4000 bu. of wheat. His commission at 2½% was \$56; storage and freight \$104. How much per bushel did the wheat cost his employer?

7. An attorney collected 65% of a debt, charging 5% for collecting. His commission was \$23.40. What was the sum collected, and what the full amount of the debt?

8. An agent collected 80% of a firm's outstanding claims, charging 2¼% for collecting. If the amount paid over to the firm was \$5348, what was the sum collected, and what was the full amount of the firm's outstanding claims?

9. My agent bought \$325 worth of produce for me. After paying the commission and \$8.25 freight, the produce cost me \$347.87½. What was the rate of commission?

10. I shipped my agent in Philadelphia 280 bbl. of apples, with instructions to sell them so that I might realize \$2.55 per bushel, after paying a commission of 15%. Find his commission.

11. I sold goods that cost \$1250 for \$1750. What per cent profit did my employer make if I charged him \$87½ commission, \$25 freight, and \$12½ cartage? Find my rate of commission.

12. For how much must flour that cost \$7.50 a barrel be sold to gain 16⅔%, after deducting a commission of 5%?

13. An agent sold 1600 bbl. of flour at \$6.52½. After deducting his commission, he remitted \$8595. Find the rate of commission.

TRADE DISCOUNT

LESSON 42

Discount is a deduction made from the amount of a bill, or of a debt, for cash payment, or for other reasons. It is not an unusual thing for manufacturers or wholesale dealers to make two or more deductions from the nominal or list price of goods. These successive deductions are called **Commercial** or **Trade Discounts**. When two or more deductions are made, the first is taken from the list, or gross price; the second, from the remainder; the third, from the second remainder, etc.

1. A man bought a bill of goods amounting to \$600, at 20, 10, and 5% off. What was the net cost?

OPERATION

$$\$600 \times .80 = \$480 = 20\% \text{ off.}$$

$$\$480 \times .90 = \$432 = 20 \text{ and } 10\% \text{ off.}$$

$$\$432 \times .95 = \$410.40 = 20, 10, \text{ and } 5\% \text{ off, or net cost. } \textit{Ans.}$$

2. A merchant sold a bill of goods amounting to \$1680, at a discount of $12\frac{1}{2}\%$ for cash. What was the discount?

3. I bought table knives, listed at \$4.50 a set, at 50 and 8% off. How much did they cost me?

4. I bought carpet, listed at \$1 a yard, at 15 and 10% off, an additional discount of 5% being allowed me for cash. How much did the carpet cost me a yard?

5. Find a single discount equal to 20, 10, and 5% off.

OPERATION

$$1.00 \times .80 = .80 = 20\% \text{ off.}$$

$$.80 \times .90 = .72 = 20 \text{ and } 10\% \text{ off.}$$

$$.72 \times .95 = .684 = 20, 10, \text{ and } 5\% \text{ off.}$$

$$1.00 - .684 = .316 = 31.6\% = 31\frac{3}{5}\%. \text{ Ans.}$$

6. What is the difference between 35% off and 20, 10, and 5% off?

$$20, 10, \text{ and } 5\% \text{ off} = 31\frac{3}{5}\% \text{ (see operation above).}$$

$$35\% - 31\frac{3}{5}\% = 3\frac{2}{5}\%. \text{ Ans.}$$

7. What is the difference between 40% off and 4 tens off? Between 30% off and 15 and 15% off?

8. What is the difference between 15 and 10% off, and 10 and 15% off?

9. What single discount is equal to 80, 10, and 5% off?

10. My agent bought a bill of hardware for me at 30 and 4% off the list price, and charged me 5% for buying. My entire bill was \$529.20. What would have been the amount of my bill had the goods been purchased at list price?

11. A merchant paid \$3200 for a bill of goods. He wishes to realize a profit of 25% after making a discount of 20 and 16 $\frac{2}{3}$ %. Find the marked price.

12. If from the retail price of silk 20% is deducted, and a discount of 10% is made on the balance, and then the silk sells for \$2.61 a yard, what is the retail price?

13. A merchant who allows a discount of 20% from the list price, and 5% off for cash, receives \$524.40 as the net price of a bill of goods. Find the list price.

TAXES

LESSON 43

A **Tax** is a sum of money assessed on persons, property, certain incomes, productions, etc., to be used for public purposes.

In some states there is levied what is called a **Poll**, or **Capitation Tax**. This tax varies in amount in different states, and is assessed on the person of each male citizen over twenty-one years of age.

A **Property Tax** is a tax on property, and is a certain percentage of its assessed value.

Property is divided into two classes, — **Real Estate** and **Personal Property**.

Real Estate consists of immovable property, such as lands and houses. **Personal Property** consists of movable property, such as furniture, utensils, merchandise, cattle, etc.

The assessed valuation of property corresponds to the *base*; the rate of taxation to the *rate per cent*, and the tax to the *percentage*.

Formulate a rule:

1. To find the tax when the assessed valuation and rate are given.
2. To find the rate when the assessed valuation and tax are given.
3. To find the assessed valuation when the rate and tax are given.

4. If the taxable property of a town is \$368,570, and the rate is $1\frac{3}{4}\%$, find the whole amount of the tax.

5. The assessed valuation of the property of a town is \$857,380. A tax of \$21,434.50 is to be assessed. Find the rate of taxation. How many mills on each dollar?

6. If the tax in a city is \$71,650, and the rate is $2\frac{1}{2}\%$, what is the assessed valuation?

In computing taxes the entire sum to be raised is diminished by the amount of the poll taxes, if there is any; and the remainder divided by the valuation of the taxable property gives the tax on each dollar.

LESSON 44

1. In a certain town a tax of \$47,073.90 is to be raised. The taxable property is valued at \$2,932,260. There are 2060 persons to pay a poll tax of \$1.50 each. Find the amount of the poll taxes. Find the amount to be raised by taxing the property. What is the tax rate? What is the tax on each dollar? On \$100? On \$1000?

2. Using the rate of taxation found in Ex. 1, find the tax paid by Mr. Rudolph, who pays a poll tax of \$1.50, and who owns property valued at \$8400.

3. Mr. Flint lives in a town in which the taxable property is valued at \$1,600,000. A tax of \$25,000 is to be levied. There are 500 persons subject to a poll tax of \$2 each. Find Mr. Flint's tax, if he is assessed \$8650 for real estate and \$3750 for personal property.

4. The assessed value of a man's property is \$15,000. If he pays $3\frac{1}{2}$ mills city tax, 13 mills school tax, 2 mills poor tax, $\frac{1}{2}$ mill bridge tax, and \$1.50 poll tax, what is the amount of his taxes?

5. Mr. Farnham owns real estate valued at \$8800, personal property valued at \$3270, and has \$5300 on interest. If he pays $2\frac{1}{2}\%$ on $\frac{1}{4}$ of the value of the real estate, $2\frac{3}{8}\%$ on $\frac{1}{3}$ of the value of the personal property, and 3 mills on the money at interest, what is the amount of his taxes?

6. At the rate of 3 mills on the dollar, what must be the assessed value of property to yield \$19,260 tax?

7. A school district needs \$24,000 for building purposes, \$15,000 for salary of teachers, and \$5000 for other expenses. The state appropriates \$3000, and the rest is to be raised on taxable property valued at \$4,100,000. What is the tax rate?

8. What sum must be assessed, at 9 mills on the dollar, in order to raise \$726.75 tax, after allowing 5% for collecting?

9. A county needs \$5600 to build a bridge. Allowing 3% for collecting, what amount of property must be taxed, at 4 mills on the dollar, to raise the requisite sum?

10. The assessed value of the property of a town is \$192,000. What must be the rate in order to raise \$1536 tax?

DUTIES OR CUSTOMS

LESSON 45

The money necessary to defray the expenses of the national government is obtained from indirect taxes, that is, taxes assessed upon the property of one person, but indirectly paid by another person called the consumer.

Ordinarily these taxes are received from two sources,—from taxes imposed on articles manufactured or produced

in this country, called **Internal Revenue** or **Excise Taxes**, and from taxes imposed on merchandise imported from foreign countries.

The government receives the largest part of its internal revenue from taxes on the manufacture and sale of oleo-margarine, alcoholic liquors, tobacco products, such as cigars, cigarettes, snuff, etc., and from the sale of stamps.

Duties are of two kinds,—ad valorem and specific. An **Ad Valorem Duty** is a certain per cent of the cost of the goods in the country from which they are imported. A **Specific Duty** is a duty assessed on the quantity or bulk of goods without regard to their cost.

The schedule or list of articles upon which duties are to be paid is called a **Tariff**.

Duties are collected by officers of the government at customhouses which are located at certain cities designated by law and called ports of entry.

Ports of entry are usually on or near the seacoast. Importers are required to submit to the collector of customs at the customhouse an itemized bill, called an **Invoice**, showing the quantity of the goods and their cost in the place from which they are imported.

Since duties are computed on the actual quantity of merchandise, the goods are inspected, weighed, measured, gauged, etc., by government officers to ascertain how much of the merchandise will be available in market. Hence certain allowances called tare, leakage, and breakage are made in every case.

Tare is an allowance made for the weight of box, bag, cask, etc., containing the goods.

Leakage is an allowance made for loss of liquors when imported in barrels, casks, etc.

Breakage is an allowance made for loss of liquors when imported in bottles.

1. How is the money obtained to pay the expenses of the national government? What is meant by an indirect tax?

NOTE.—Direct taxes are discussed in Lesson 43. The federal government has authority to lay a direct tax also, but it makes use of that power only when its expenses are very great—as in time of war.

2. What is an internal revenue? What are duties?
3. Where are duties collected? What are ports of entry?
4. What is an ad valorem duty? Specific duty?

LESSON 46

1. Define tariff; invoice; tare; leakage; breakage.
2. Find the duty on 300 yd. of silk, invoiced at \$1.30 per yard, at 50% ad valorem.
3. What is the duty on 10 pieces of woolen cloth, 40 yd. each, invoiced at \$1.40 per yard, the ad valorem duty being 40%?

In computing duties, whole yards, gallons, dollars, etc., are considered as the base. Fractions less than $\frac{1}{2}$ are rejected; all others are regarded as 1.

Both specific and ad valorem duties are levied on certain articles.

4. A merchant imported 1200 yd. of Brussels carpet valued at 90¢ a yard. Find the duty, the specific duty being 44¢ a yard, and ad valorem 40%.
5. Find the duty on sealskin sacks valued at \$960, the duty being 35%.
6. Find the duty on 12 gross of table knives invoiced at \$2 $\frac{1}{2}$ a dozen, the specific duty being 40¢ a dozen, and the ad valorem duty 30%.

7. Find the duty, at \$1.50 per pound and 25 % ad valorem, on 500 boxes of cigars, each containing 100 cigars, invoiced at \$4.25 per box, and weighing $12\frac{1}{2}$ lb. per 1000.

8. What is the duty, at 3 ¢ a gallon, on 20 hogsheads of molasses, each containing 63 gal., leakage 2 % ?

9. A jeweler imported 20 doz. watches from Geneva, invoiced at 420 francs per doz. Find the duty at 25 % ad valorem, allowing a franc to equal \$.193.

NOTE. — When foreign money is changed to United States money, the duty is reckoned on the nearest dollar.

10. What is the duty at 10 % ad valorem, on 100 doz. bottles of olives, invoiced in Italy at 5 liras per dozen, allowing 2 % for breakage ? (A lira equals \$.193.)

11. How much duty must be paid on an invoice of 10 gross of linen cuffs, valued at 96 ¢ a dozen, the specific duty being 30 ¢ per dozen, and ad valorem duty 30 % ?

12. Find the duty on 300 bags of cocoa, the gross weight of each bag being 60 lb., at 3 ¢ per pound, allowing 2 % for tare.

13. A music dealer imported 100 guitars invoiced in Germany at 40 marks each. After paying a duty of 25 %, at what price each must he sell them to gain 20 % on the total cost ? (A mark equals \$.238.)

14. Where and by whom are duties collected ?

15. How much is the duty at 4 ¢ a gallon, on 50 hhd. (63 gal. each) of molasses, leakage 2 % ?

16. Find the duty, at 3 ¢ per pound, on 50 hhd. (500 lb. each) of sugar, tare 4 %.

17. A merchant imported china ware invoiced at £ 420
10 s. Find the duty at 50 % ad valorem.

INSURANCE

LESSON 47

Insurance is a contract by which one party, usually a company, agrees to indemnify another against loss or damage.

Insurance is of two kinds, — property insurance and life insurance.

An **Insurance Policy** is a certificate of insurance made by the insurance company with the party insured. The **Premium** is the sum of money paid by the insured for the insurance. It is estimated at a certain rate per cent of the amount insured.

As a security against fraud most companies do not insure property for its full value.

1. What is insurance? Insurance is of how many kinds? Name some of the kinds of property insurance.

2. What is the premium? The policy?

3. Find the premium for an insurance of \$2500 on a house, at $1\frac{3}{4}\%$.

It is customary for insurance companies to insure property for a period of years, say 1, 3, or 5 yr., charging a certain number of cents on the hundred dollars, according to the class of risk. It is also customary for companies to charge twice the annual rate for insuring property for 3 yr., and three times the annual rate for 5 yr.

For example, if the annual rate is \$.65 for each \$100, the rate for 3 yr. is *two* times \$.65, or \$1.30, and for 5 yr. it is *three* times \$.65, or \$1.95 for each \$100.

4. Mr. James insured his house for \$2500, and his furniture for \$1000, for 3 yr. The annual rate was \$.65 for each \$100. The rate for 3 yr. was twice the annual rate. Find the premium.

5. A merchant had 1200 bbl. of flour worth \$4.50 a barrel, insured for $\frac{3}{4}$ of its value at $1\frac{1}{2}\%$. Find the premium.

6. A house valued at \$5200 was insured for $\frac{3}{4}$ of its value, at \$1.25 for each \$100, for 3 yr. Find the premium.

7. A lace factory is worth \$6400, and the machinery \$7520. The factory is insured for 80% of its value, at $1\frac{3}{4}\%$, and the machinery for 75% of its value, at $1\frac{2}{3}\%$. Find the premium.

8. A man insured $\frac{2}{3}$ of the value of a stock of goods at $1\frac{3}{4}\%$, and paid \$97.92 premium. Find the value of the goods.

SUGGESTION.— $\$97.92 \div .01\frac{3}{4} = \frac{2}{3}$ of the value of the goods.

LESSON 48

1. The cost of insuring 90% of a cargo of grain, at $2\frac{1}{2}\%$, was \$262. Find the value of the cargo of grain.

2. A warehouse, worth \$4320, was insured for $\frac{3}{4}$ of its value. The premium was \$108. What was the rate of insurance?

3. A man paid \$78.75 for insuring a building for 5 yr. The 5 yr. rate was three times the annual rate, which was \$.75 a \$100. Find the value of the building.

4. A merchant gets his stock, worth \$12,000, insured for $\frac{3}{4}$ of its value, at $\frac{3}{4}\%$. If, in case of a fire, he saves \$2000 of his stock, what will be his actual loss?

5. My store is worth \$10,000 and the goods are valued at \$8000. I have the store insured for 75% of its value at \$.42 $\frac{1}{2}$ a \$100 annually, for 3 yr., and the goods for 80% of their value for 3 yr., at 1 $\frac{1}{2}\%$ per annum. If a fire should occur, what would be my loss, provided I succeeded in saving \$2000 worth of goods?

6. It cost \$462.50 to insure property for $\frac{1}{2}$ of its value at \$1.25 a hundred dollars. Find the whole value of the property.

There are several kinds of policies issued by life insurance companies. Only two kinds will be considered,—life policies and endowment policies.

Life Policies are payable at the death of the insured. There are two kinds of life policies. According to the provisions of one kind, the annual premium continues during life; they are sometimes called *straight life policies*.

According to the provisions of the other kind, the annual premium continues ten years, fifteen years, twenty years, etc.; these are sometimes called ten, fifteen, or twenty payment life policies.

Endowment Policies are payable to the person insured at the end of a period of years, as ten, fifteen, twenty, or twenty-five years. If the person insured dies before the maturity of the policy, the amount is paid at his death to his heirs.

7. A man 30 yr. of age took out a *straight life* policy for \$5000, at the annual rate of \$23.30 per \$1000. He died at the age of 62 yr., and the company paid his widow

\$5000. How much more did the widow receive than the sum of the annual premiums?

8. A man aged 24 yr. insured his life for \$3000 on the ten-payment life plan, at the rate of \$42.43 per \$1000. He died at the age of 42 yr. How much more did his heirs receive from the company than was paid to it?

9. Mr. Kaiser, at 28 yr. of age, took out an endowment policy according to the terms of which he will receive \$4000 when he is 48 yr. of age. If the annual premium is \$48.07 per thousand dollars, how much more will he receive from the company when the policy matures than he has paid to it?

10. Mr. Gresh, aged 35 yr., insured his life for \$10,000, on the twenty-payment life plan, at an annual premium of \$49.21 per thousand dollars. He died after making sixteen payments. Had he taken a straight life policy instead, how much money would he have saved, the annual premium being \$26 per \$1000?

11. A school building worth \$60,000 was insured for 80% of its value in three companies. The first took 25% of the risk at $\frac{7}{8}\%$; the second took 40% of it at 1%, and the third took the remainder at $1\frac{1}{8}\%$. Find the total premium.

12. A man 36 yr. old took out a 20-year endowment policy for \$10,000. If he pays an annual premium of \$49.76 per \$1000, how much money will he have paid in if he lives till the policy matures?

13. A man paid \$81 for insuring property for $\frac{3}{4}$ of its value, at $1\frac{1}{8}\%$. Find the value of the property.

INTEREST

LESSON 49

Interest is money paid for the use of money.

The **Principal** is the sum loaned.

The **Amount** is the sum of the principal and interest.

The **Rate** is the per cent of the principal paid for its use for 1 yr.

The **Time** is the period for which interest is charged.

It is customary to regard 30 da. as a month and 360 da. as a year.

1. What is the interest of \$648 for 5 yr. 10 mo. 15 da. at 6%?

OPERATION

Time reduced to months = 70.5 mo.

$$\$648 \times .06 = \$38.88 = \text{int. for 1 yr.}$$

$$\$38.88 \div 12 = \$3.24 = \text{int. for 1 mo.}$$

$$\$3.24 \times 70.5 = \$228.42. \text{ Ans.}$$

2. Find the interest of \$2040 for 3 yr. 6 mo. 9 da. at 5%.

3. Find the interest of \$3928 for 2 yr. 4 mo. 5 da. at 7%.

4. Find the interest of \$4128.50 for 4 yr. 8 mo. 6 da. at 8%.

5. Find the interest of \$560 for 90 da. at 6%.

OPERATION

$$90 \text{ da.} = \frac{90}{360}, \text{ or } \frac{1}{4} \text{ a year.}$$

$$\$560 \times .06 \times \frac{1}{4} = \$8.40. \text{ Ans.}$$

6. Find the interest of \$2140 for 80 da. at 6%.
7. Find the interest of \$7562.20 for 210 da. at $5\frac{1}{2}\%$.
8. Find the interest of \$9684.26 for 185 da. at 4%.
9. Find the interest of \$650 from Sept. 20, 1900, to March 5, 1903, at 6%.

Years	Months	Days
1903	3	5
1900	9	20
<hr/>		
Time =	2	5 15

Time reduced = 29.5 mo.

$\$650 \times .06 = \text{int. for 1 yr.}$

Int. for 1 yr. $\div 12 = \text{int. for 1 mo.}$

Int. for 1 mo. $\times 29.5 = \text{int. for required time.}$

Make statements similar to the preceding one of the following three examples:

10. Find the interest of \$2452 from Oct. 4, 1900, to May 6, 1901, at 5%.
11. Find the interest of \$684.84 from Feb. 5, 1900, to March 15, 1901, at 5%.
12. Find the interest of \$576.85 from April 1, 1900, to July 3, 1904, at $7\frac{3}{4}\%$.

Complete the following table:

	Prin.	Rate	Time	Interest	Amount
13.	\$380	$5\frac{1}{2}\%$	2 yr. 3 mo. 9 da.	?	?
14.	\$ 36.80	6 %	5 yr. 4 mo. 18 da.	?	?
15.	\$164.30	$3\frac{3}{4}\%$	9 mo.	?	?
16.	\$364.60	$5\frac{1}{4}\%$	95 da.	?	?

Six Per Cent Method

LESSON 50

1. Find the interest of \$480 for 3 yr. 6 mo. 15 da. at 5%.

OPERATION

The interest of \$1 for 1 yr., at 6%, is \$.06; for 1 mo. it is $\frac{1}{12}$ of \$.06, which is \$.00 $\frac{1}{2}$; and for 1 da. it is $\frac{1}{360}$ of \$.00 $\frac{1}{2}$, which is \$.00 $\frac{1}{720}$, or \$.000 $\frac{1}{4}$.

$$\text{Int. of \$1 for 3 yr.} = 3 \times \$.06 = \$.18$$

$$\text{Int. of \$1 for 6 mo.} = 6 \times \$.00\frac{1}{2} = \$.03$$

$$\text{Int. of \$1 for 15 da.} = 15 \times \$.000\frac{1}{4} = \$.0025$$

$$\text{Int. of \$1 for 3 yr. 6 mo. 15 da.} = \$.2125$$

$$\text{Int. of \$480} = 480 \times \$.2125 = \$102. \quad \text{Ans.}$$

As the interest of \$1 for 1 mo. is $\frac{1}{12}$ of a cent, and for 1 da. $\frac{1}{360}$ of a mill, another method is to reduce the time to months and days, and take $\frac{1}{12}$ as many cents as there are months, and $\frac{1}{360}$ as many mills as there are days.

2. Find the interest of \$500 for 4 yr. 8 mo. 18 da. at 6%.

OPERATION

Time reduced = 56 mo. 18 da.

$$\text{Int. of \$1 for 56 mo.} = \frac{1}{2} \text{ of } 56, \text{ or } \$.28$$

$$\text{Int. of \$1 for 18 da.} = \frac{1}{360} \text{ of } 18, \text{ or } \$.003$$

$$\text{Int. of \$1 for 4 yr. 8 mo. 18 da.} = \$.283$$

$$\text{Int. of \$500} = 500 \times \$.283 = \$141.50. \quad \text{Ans.}$$

3. What is the interest of \$270 for 2 yr. 4 mo. 24 da., at 6%?

4. What is the interest of \$645 for 5 yr. 8 mo. 28 da., at 6%?

5. What is the interest of \$3860 for 6 yr. 3 mo. 27 da., at 6%?

6. Find the interest of \$380.25 for 2 yr. 4 mo. 6 da., at 6%.

7. Find the interest of \$230.60 for 8 yr. 2 mo. 18 da., at 6%.
8. Find the interest of \$726.40 for 8 mo. 24 da., at 6%.
9. Find the interest of \$75.75 for 3 yr. 9 mo. 10 da., at 6%.
10. Find the interest of \$375.80 for 7 mo. 21 da., at 6%.
11. Find the interest of \$4670 from April 1, 1900, to June 7, 1902, at 6%.

LESSON 51

At 6%, $\frac{1}{100}$ of the principal equals the interest for 1 yr., and for 1 mo. the interest equals $\frac{1}{12}$ of $\frac{1}{100}$, or $\frac{1}{1200}$ of the principal. *Therefore, the interest for 1 mo., at 6%, may be obtained by dividing the principal by 200, which is the same as dividing the principal by 2 and moving the decimal point two places to the left.*

1. Find the interest of \$832 for 3 yr. 7 mo. 18 da., at 6%.

Time reduced = 43.6 mo.

By dividing \$832 by 2 and moving the decimal point *two* places to the left, we have \$4.16 as the interest for 1 mo.

$$\$4.16 \times 43.6 = \$181.376. \text{ Ans.}$$

2. Find the interest of \$462.36 for 7 yr. 9 mo. 21 da., at 6%.
3. Find the interest of \$792.25 for 2 yr. 11 mo. 27 da., at 6%.
4. Find the interest of \$3846.31 for 9 yr. 2 mo. 8 da., at 6%.

Since the interest for 1 mo., or 30 da., at 6% equals $\frac{1}{100}$ of the principal, for 1 da. it will equal $\frac{1}{30}$ of $\frac{1}{100}$, or $\frac{1}{3000}$ of the principal. *Therefore, the interest for 1 da., at 6%, may be obtained by dividing the principal by 6000, or, which is the same, by dividing the principal by 6, and moving the decimal point *three* places to the left.*

5. Find the interest of \$6960 for 126 da., at 6%.

By dividing \$6960 by 6, and moving the decimal point *three* places to the left, we have \$1.16, the interest for 1 da.

Hence $\$1.16 \times 126 = \146.16 . *Ans.*

6. Find the interest of \$4387 for 38 da., at 6%.
 7. Find the interest of \$368.42 for 65 da., at 6%.
 8. Find the interest of \$8460.31 for 186 da., at 6%.

LESSON 52

The *six per cent* method may be employed to find the interest at any other per cent. When the rate is 5%, take $\frac{5}{6}$ of the interest at 6%; when 7%, take $\frac{7}{6}$ of the interest at 6%, etc.

1. Find the interest of \$462.36 for 4 yr. 5 mo. 27 da., at 8%.

OPERATION

Time = 53.9 mo.

$\$462.36 \div 200 = \$2.311 = \text{int. for 1 mo. at 6\%}$

$\$2.311 \times 53.9 \times \frac{4}{3} = \166.08 . *Ans.*

Find the interest of :

2. \$362.41 for 8 mo., at 6%.
 3. \$724.36 for 7 mo. 21 da., at 5%.
 4. \$642.37 for 3 yr. 4 mo. 11 da., at $4\frac{1}{2}\%$.
 5. \$3946.21 $\frac{1}{2}$ for 4 yr. 125 da., at $5\frac{1}{2}\%$.
 6. \$7643.01 $\frac{1}{4}$ for 266 da., at $7\frac{1}{2}\%$.
 7. What is the amount of \$3624.61 for 2 yr. 3 mo. 24 da., at 7%?
 8. What is the amount of \$468.42 for 7 yr. 6 mo. 17 da., at $5\frac{1}{2}\%$?
 9. What is the amount of \$5642.10 for 4 yr. 78 da., at 1% a month?

10. What is the amount of \$7624.65 for 287 da., at $1\frac{1}{2}\%$ a month?

11. What is the amount of \$9864.32, from Jan. 9, 1900, to Nov. 16, 1902, at $3\frac{1}{2}\%$?

12. What is the amount of \$1738.46, from March 23, 1900, to Dec. 4, 1903, at $.5\%$ a month?

13. Find the interest of \$4670, from April 1, 1900, to June 8, 1902, at 3% .

14. Find the interest of \$960.20, from July 3, 1900, to Aug. 27, 1904, at 6% .

LESSON 53

1. Find the interest of \$1326.28 for 7 yr. 3 mo. 6 da., at 5% ?

Time = 87.2 mo.

STATEMENT

$$(\$1326.28 \div 200) \times 87.2 \times \frac{1}{2} = \text{answer.}$$

2. Find the interest of \$362.48 for 2 yr. 11 mo. 23 da., at $4\frac{1}{2}\%$.

SUGGESTION. — At $4\frac{1}{2}\%$, the int. is $\frac{4\frac{1}{2}}{6}$, or $\frac{1}{4}$ of the int. at 6% .

3. Find the interest of \$6721.39 for 8 yr. 9 mo. 16 da., at $5\frac{1}{2}\%$.

4. Find the interest of \$1722.78, from April 1, 1900, to June 3, 1904, at $6\frac{1}{4}\%$.

5. Find the amount of \$3846.30, from May 29, 1900, to Sept. 14, 1903, at $3\frac{3}{4}\%$.

6. Find the interest of \$9648.54 for 66 da., at 7% .

STATEMENT

$$(\$9648.54 \div 6000) \times 66 \times \frac{1}{4} = \text{answer.}$$

7. Find the interest of \$3847.52 for 136 da., at 3% .

8. Find the interest of \$7643.61 for 125 da., at $7\frac{1}{2}\%$.

9. Find the amount of \$9438.74 $\frac{1}{2}$ for 216 da., at 3 $\frac{3}{4}$ %.
10. Find the amount of \$3684.37 $\frac{3}{4}$ for 162 da., at 4 $\frac{1}{4}$ %.
11. Mr. Seibel loaned \$364.40 June 3, 1900. How much will be due him May 24, 1901, at 6%?
12. Find the interest due July 14, 1903, on a note for \$2160, at 6%, dated April 1, 1900.
13. A note dated Aug. 3, 1900, for \$2756, was paid Nov. 25, 1902. What was the amount due at 5 $\frac{1}{2}$ %?

Exact Method

LESSON 54

In computing interest for a period of time less than a year, the United States government takes the exact number of days, and reckons the interest for that part of a year which the given number of days is of 365 da.

1. Find the exact interest of \$400 for 135 da., at 5%.

STATEMENT

$$\$400 \times .05 \times \frac{135}{365} = \text{answer.}$$

2. Find the exact interest of \$860 for 129 da., at 6%.
3. Find the exact interest of \$385.40 for 245 da., at 5 $\frac{1}{2}$ %.

4. Find the exact interest of \$2000, from March 23 to July 8, at 6%.

Time = 107 da.

STATEMENT

$$\$2000 \times .06 \times \frac{107}{365} = \text{answer.}$$

5. Find the interest of \$3860 from Jan. 1, 1900, to Aug. 9, 1900, at 4 $\frac{1}{2}$ %.
6. Find the amount of \$3786 from April 1 to Oct. 17, at 7%.

7. Find the interest of \$5370 from Dec. 29, 1900, to Sept. 15, 1901, at $3\frac{1}{2}\%$.

8. Find the interest of \$4575 from April 25, 1900, to Sept. 15, 1901, at 6% .

Time from April 25, 1900, to April 25, 1901 = 1 yr.

Time from April 25, 1901, to Sept. 15, 1901 = 143 da.

Time = $1\frac{143}{365}$ yr.

STATEMENT

$$\$4575 \times .06 \times 1\frac{143}{365} = \text{answer.}$$

9. What is the amount of \$1750.96 from July 27, 1900, to Nov. 20, 1901, at 6% ?

10. What is the amount of \$8362.50 from Feb. 26, 1900, to June 18, 1901, at 4% ?

11. What is the interest, at $5\frac{1}{2}\%$, of \$3862.25 from May 12, 1900, to Nov. 23, 1902?

LESSON 55

1. What principal will earn 6% interest in 1 yr. at 6% ?
What principal will earn 12% interest in the same time at 6% ?

2. Since \$1 earns 6% interest in 1 yr. at 6% , how many dollars will be required to earn 18% interest in the same time? 36% ? 48% ? 66% ? \$1.20? \$3.60? \$9.60?

3. Since \$100 at 6% earns \$6 interest in 1 yr., what principal will earn \$24 interest in the same time? \$42? \$54? \$72?

4. How much interest will \$1 gain at 5% in 1 yr.? How many dollars at the same rate will it take to earn 50% in 1 yr.? \$1.50? \$3.50? \$7.50?

5. At 4% , what is the interest of \$1 for 1 yr.? For 2 yr.? For 2 yr. 6 mo.? For 3 yr. 9 mo.?

6. At 4%, how many dollars will be required to earn \$12 interest in 1 yr.? To earn \$84 in 1 yr.? To earn \$96 in 2 yr.?

7. What principal will earn \$.80 in 4 yr., at 5%?

SOLUTION. — One dollar in 1 yr., at 5%, will earn 5¢, and in 4 yr. 4 times 5¢, or 20¢. To earn 80¢ it will require as many dollars as 20¢ is contained times in 80¢, or \$4.

8. What principal will earn \$1.20 interest in 3 yr., at 5%?

9. What principal will earn \$1.50 in 3 yr., at 5%?

10. How much interest will \$1 earn in 3 yr. 6 mo., at 6%? What principal will be required to earn \$2.52 in the same time, at 6%?

11. Can you formulate a rule for finding the principal when the time and rate are given?

12. What principal will give an interest of \$83.25 in 3 yr. 9 mo., at 6%?

OPERATION

Time = 45 mo.

\$1.00 ÷ 200 = \$.005, int. of \$1.00 for 1 mo. at 6%

\$.005 × 45 = \$.225, int. of \$1.00 for 45 mo. at 6%

\$83.25 ÷ \$.225 = 370. \$370. *Ans.*

13. What principal will give an interest of \$43.74 in 4 yr. 6 mo., at 6%?

14. What principal will give an interest of \$494.73 in 5 yr. 9 mo., at 6%?

15. What principal will give an interest of \$2110.23 in 4 yr. 3 mo., at $5\frac{1}{2}\%$?

SUGGESTION. — At $5\frac{1}{2}\%$, the interest = $\frac{5\frac{1}{2}}{6}$, or $\frac{11}{12}$ of the interest at 6%.

16. What principal will give an interest of \$250.60 in 7 yr. 8 mo., at $4\frac{1}{2}\%$?

17. What principal will give an interest of \$225.21 in 3 yr. 8 mo. 21 da., at 7% ?

18. What principal will give an interest of \$47.56, at $4\frac{1}{2}\%$, from Jan. 3, 1900, to April 6, 1902 ?

LESSON 56

1. What principal will amount to \$459.80 in 3 yr. 6 mo., at 6% ?

OPERATION

Time = $3\frac{1}{2}$ yr.

$$\$1.00 \times .06 \times 3\frac{1}{2} = \$.21 = \text{int. of } \$1 \text{ for 3 yr. 6 mo. at } 6\%$$

$$\$1.00 + \$.21 = \$1.21 = \text{amt. of } \$1 \text{ for 3 yr. 6 mo. at } 6\%$$

$$\$459.80 \div \$1.21 = 380. \quad \$380. \quad \text{Ans.}$$

2. What principal will amount to \$446.50 in 3 yr. 6 mo., at 5% ?

3. What principal, at $3\frac{1}{2}\%$, will amount to \$922.26 $\frac{2}{3}$ in 4 yr. 4 mo. 12 da. ?

4. What principal, at 7%, will amount to \$1498.20 from March 9, 1900, to Sept. 27, 1903 ?

5. At what rate will \$400 give an interest of \$64 in 4 yr. ?

OPERATION

$$\$400 \times .01 \times 4 = \$16 = \text{int. for 4 yr. at } 1\%$$

$$\$64 \div \$16 = 4. \quad \text{Rate is } 4\%. \quad \text{Ans.}$$

If \$400 at 1% for 4 yr. gives an interest of \$16, to give an interest of \$64 it will require as many per cent as \$16 is contained times in \$64, or 4. Therefore the rate is 4%.

6. At what rate will \$250 give an interest of \$33.75 in 1 yr. 6 mo. ?

7. At what rate will \$500 give an interest of \$105 in 2 yr. ?

8. At what rate will \$145 amount to \$174.435 in 3 yr. 4 mo. 18 da. ?

OPERATION

Time = 40.6 mo.

\$174.435 - \$145 = \$29.435 = the interest for 3 yr. 4 mo. 18 da.

$(\$145 \times .01) \div 12 = \$12\frac{1}{2}$ = int. for 1 mo. at 1%.

$40.6 \times \$12\frac{1}{2} = \$4.905\frac{1}{2}$ = int. for 40.6 mo. at 1%.

$\$29.435 \div \$4.905\frac{1}{2} = 6$. Rate is 6%. *Ans.*

9. At what rate will \$26.50 amount to \$40.624 $\frac{1}{2}$ in 8 yr. 10 mo. 18 da. ?

10. At what rate will \$9750 amount to \$12,986.45 $\frac{5}{8}$ in 6 yr. 7 mo. 20 da. ?

11. At what rate will \$840 amount to \$968.10 in 3 yr. 18 da. ?

LESSON 57

1. In what time will \$468 gain \$98.28 at 6% ?

OPERATION

$\$468 \times .06 = \28.08 = int. for 1 yr. at 6%.

$\$98.28 \div \$28.08 = 3\frac{1}{2}$. 3 $\frac{1}{2}$ yr., or 3 yr. 6 mo. *Ans.*

The interest of \$468 for 1 yr. at 6% is \$28.08, and to produce an interest of \$98.28 it will require as many years as \$28.08 is contained times in \$98.28, or 3 $\frac{1}{2}$. Therefore the time is 3 $\frac{1}{2}$ yr., or 3 yr. 6 mo.

In what time will :

2. \$1500 gain \$105 at 6% ?

3. \$720 gain \$88.20 at 7% ?

4. \$1880 gain \$216.20 at 6% ?

5. \$ 648 gain \$ 228.42, at 6% ?
6. \$ 175 amount to \$ 214.81 $\frac{1}{4}$, at 7% ?
7. \$ 560 amount to \$ 673.40, at 6% ?
8. Find the interest of \$ 726.30 from Feb. 7, 1900, to April 9, 1905, at 3 $\frac{1}{2}$ %.
9. How much interest will be due at the end of 123 da. on a note for \$ 1763, at 5% ?
10. A man wishes to place such a sum of money on interest at 4 $\frac{3}{4}$ % as will yield him \$ 427.50 annually. Find the required sum.
11. What amount is due on a note for \$ 425, dated July 23, 1900, and paid April 1, 1903, at $\frac{1}{2}$ % a month ?
12. Find the interest of \$ 5052 for 88 da., at 7%.
13. Find the amount of \$ 2760 for 126 da., at 5%.
14. Find the exact interest of \$ 3862 from Aug. 24, 1900, to Jan. 3, 1906, at 3 $\frac{1}{2}$ %.
15. Find the exact interest of \$ 292 for 318 da., at 5%.
16. Find the amount due on a note for \$ 462.80, dated Sept. 21, and paid Dec. 18, at 4 $\frac{1}{2}$ %, exact interest.
17. What principal, at 5%, yields an interest of \$ 159.82 in 3 yr. 8 mo. 18 da. ?
18. In what time will \$ 1446.33 gain $\frac{5}{8}$ of itself, at 7% ?
19. At what rate will \$ 3750 gain \$ 156.25, in 5 mo. ?
20. A certain sum of money invested at 6% for 11 yr. amounted to \$ 1162. In how many years, at the same rate, would it amount to \$ 1234.45 ?
21. What sum of money invested at 6% for 1 yr. 4 mo. will amount to the interest of \$ 2000 for 6 yr. 6 mo. at 4% ?

22. What sum of money, at $4\frac{1}{2}\%$, will yield a semi-annual income of \$388.678?

23. A friend loaned me \$463.50, at 6%, which I kept till it amounted to \$472.77. How long did I keep it?

LESSON 58

1. What is interest? Principal? Rate? Amount? Time?

2. In what time will \$100 double itself at 5%?

SOLUTION. — To double itself a principal must gain *once* itself. At 5%, \$100 will gain \$5 in 1 year, and to gain *once* itself, or \$100, it will require as many years as \$5 is contained times in \$100, or 20 yr.

3. In what time will \$100 double itself at 6%? At 7%? At 8%? At 10%? At $12\frac{1}{2}\%$? At 20%?

4. In what time will \$50 gain twice itself at 5%? At 6%? At 10%? At 15%?

5. In what time will any sum of money double itself at 5%?

SOLUTION. — To double itself any sum of money must gain 100% of itself. Hence it will require as many years as 5% is contained times in 100%, or 20 yr.

6. In what time will any sum of money double itself at 6%? 4%? 8%? 10%? $12\frac{1}{2}\%$? $16\frac{2}{3}\%$?

Complete the following table:

	Principal	Interest	Time	Rate
7.	\$1	\$.06	?	6%
8.	\$1	\$.12	2 yr.	?
9.	\$12	?	2 mo.	5%
10.	?	\$1.40	3 yr. 6 mo.	4%

	Principal	Rate	Time	Interest	Amount
11.	\$240	4½%	?	\$3.60	?
12.	\$160	?	2 yr. 1 mo. 15 da.	\$15.30	?
13.	?	4.2%	10 mo. 15 da.	\$14.70	?
14.	?	5%	11 mo. 3 da.	?	\$376.65
15.	\$800	6%	?	\$25.60	
16.	\$750	?	3 yr. 18 da.	\$91.50	
17.	\$380	?	3 yr. 9 mo.	?	\$451.25
18.	?	4%	?	\$71.50	\$621.50
19.	\$410	?	1 yr. 8 mo.	\$30	
20.	?	5%	1 yr. 3 mo. 12 da.	\$77	?
21. What sum of money will produce \$76.50 interest in 2 yr. at 5%?					
22. In what time will \$1880 produce \$864.80 interest at 6%?					
23. A man borrowed \$2400 at 6%, and kept it until it was doubled. How long did he keep it?					
24. If \$950 is put at interest at 6%, Jan. 1, 1902, at what date will the interest equal the principal?					

COMMERCIAL FORMS

LESSON 59

A **Note** is a written or printed promise to pay a certain sum of money on demand, or at a specified time.

To every note there must be two parties, the maker and the payee. The party who promises to pay is called the **Maker**; the party to whom the money is to be paid is called the **Payee**.

The **Face** of a note is the amount written in the body of the note, and usually in figures at the top or bottom.

The **Indorser** of a note is the party who, by putting his name on the back of the note, becomes responsible for its payment.

A note is *negotiable* — that is, it can be transferred from one party to another — when it is drawn payable to *bearer*, or to the *order of the payee*.

In some states *three days*, called **Days of Grace**, are allowed for the payment of a note after the expiration of the time named in the note.

The states and territories which still allow days of grace are: Alabama, Arizona, Arkansas, Georgia, Indiana, Indian Territory, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, North Carolina, Oklahoma, South Carolina, South Dakota, Texas, and Wyoming.

NOTE. — In this book days of grace are not allowed except where specified.

If a note contains the words *with interest*, it bears interest from the date of the note; if not, it bears interest from the date of maturity until paid. Though usually inserted, the words *value received* are not essential, consideration being always implied.

1. What is a note? How many parties must there be to every note?

2. Who is the maker? The payee? The indorser?

3. When is a note negotiable? What are days of grace? What is the face of a note?

4. What is said about the words *value received*?

LESSON 60

A **Demand Note** is one in which no time is specified for payment, the note being due when demand of payment is made.

1. FORM OF DEMAND NOTE

\$ 175 $\frac{35}{100}$.

HARRISBURG, PA., April 11, 1901.

On demand, I promise to pay Wilson Connor, or order,
One Hundred Seventy-five and $\frac{35}{100}$ Dollars, value received.

S. E. SWEET.

A **Time Note** is one which runs for a specified time.

2. TIME NOTE—INDIVIDUAL¹

\$ 349 $\frac{45}{100}$.

DOVER, DEL., Sept. 19, 1901.

Ninety days after date, for value received, I promise to $\frac{1}{2}$ pay John McClurg, or order, Three Hundred Forty-nine and $\frac{45}{100}$ Dollars, with interest at 5%.

H. J. FASSETT.

Find the amount due on the preceding note at maturity.

¹An individual note is one for whose payment the maker alone is responsible unless it is indorsed by others.

A **Joint Note** is one made by two or more parties who are jointly responsible for its payment.

3. FORM OF JOINT NOTE

\$ 3060 $\frac{00}{100}$

LEXINGTON, KY., May 28, 1901.

Sixty days after date, we promise to pay Samuel G. Downs, or order, Three Thousand and Sixty Dollars, with interest at $5\frac{1}{2}\%$. Value received.

WARREN STRAW,
THOMAS RIDDLE.

Find the amount due at maturity. Allow three days of grace.

A **Joint and Several Note** is one made by two or more parties who are jointly and severally responsible for its payment.

4. FORM OF JOINT AND SEVERAL NOTE

\$ 463 $\frac{37}{100}$.

PLAINFIELD, N. J., Aug. 23, 1901.

Three months after date, for value received, we jointly and severally promise to pay Jacob Payne, or order, Four Hundred Sixty-three and $\frac{37}{100}$ Dollars, with interest at 5% .

HORACE GROVE,
WILLIAM WALLACE.

Find the value of the preceding note at maturity.

A **Bankable Note** is one which is to be paid at a bank.

5. FORM OF BANKABLE NOTE

\$ 640.

BALTIMORE, MD., June 18, 1901.

Thirty days after date, for value received, we promise to pay Samuel Liggitt, or order, Six Hundred and Forty Dollars, at the First National Bank, with interest at 6% .

VOORHIS & MURRAY.

How much will be due on this note Aug. 10, 1901?

A **Surety Note** is one made payable to the order of the surety, who must indorse the note on the back to the order of the creditor.

6. FORM OF SURETY NOTE

\$ 965 $\frac{50}{100}$.

RICHMOND, VA., Oct. 3, 1901.

Four months after date, for value received, I promise to pay Edgar Alexander, or order, Nine Hundred Sixty-five and $\frac{50}{100}$ Dollars, with interest at 5%.

HORACE HOWE.

Edgar Alexander should direct the note to be paid to the order of the creditor, *H. Singerly*, by writing across the back of the note the following, "Pay to the order of H. Singerly," and signing his name.

Find the value of the preceding note at maturity

7. A 60-day note for \$890, dated March 16, without interest, was paid June 21. What was the amount due at 6%?

8. A 90-day note for \$960, dated April 5, with interest at 6% after May 10, was paid at maturity. What sum was paid?

9. A 4-month note for \$742, dated Oct. 21, 1901, with interest at 6%, was paid Feb. 24, 1902. Find the sum paid.

LESSON 61

An **Order** is a written request given on one party to deliver money, goods, or property of some kind, to another party, to his order, or to the bearer.

No. 1. ORDER FOR GOODS

\$ 10 $\frac{00}{100}$.

WILKESBARRE, PA., Jan. 2, 1900.

To WILLIAM STODDART AND CO. :

Please deliver to James Hanna, or order, goods from your store to the amount of Ten Dollars, and charge the same to my account.

WILLIAM EATON.

No. 2. ORDER FOR MONEY

\$ 15 $\frac{00}{100}$.

BALTIMORE, Md., Jan. 3, 1900.

To JAMES MORRISON :

Please pay Uriah James, or order, Fifteen Dollars, in cash, and charge the same to my account.

HENRY WOOD.

The party on whom an order may be drawn is under no legal obligations to pay it, unless he first engages to do so. Orders are usually considered payable on presentation.

A **Due Bill** is a written promise to pay a certain sum of money, or a specified amount of goods, or property of some kind to a specified person, to his order, or to the bearer.

A due bill is a kind of promissory note, though less formal than promissory notes usually are.

No. 3. DUE BILL, PAYABLE IN CASH.

\$ 21 $\frac{17}{100}$.

RICHMOND, VA., Jan. 5, 1901.

For value received, due Henry Weaver, or order, Twenty-one and $\frac{17}{100}$ Dollars.

MYRON B. SLOCUM.

No. 4. DUE BILL, PAYABLE IN GOODS.

\$ 25 $\frac{36}{100}$.

ELMIRA, N. Y., Jan. 8, 1901.

For value received, due John Anderson, or order, Twenty-five and $\frac{36}{100}$ Dollars, to be paid in goods from my store.

JAMES FULTON.

No. 5. A RECEIPT IN FULL OF ALL DEMANDS.

\$26 $\frac{31}{100}$.

KINGSTON, PA., Jan. 9, 1901.

Received of William Edwards, Twenty-six and $\frac{31}{100}$
Dollars, in full of all demands.

HENRY TYRRELL.

A **Check** is an order addressed to a bank by a depositor for the payment of a certain sum of money to a person named in the check, or to his order.

No. 6. CHECK.

No. 39.

WILKESBARRE, PA., Jan. 10, 1901.

The Wyoming National Bank of Wilkesbarre, Pa.

Pay to the order of Jonas Long, Twenty-one and $\frac{22}{100}$
Dollars.

\$21 $\frac{22}{100}$.

FRANK INNIS.

A **Postal Money Order** is an order addressed by one postmaster to another, for the payment of money to a person named, or to his order.

No. 7. POSTAL MONEY ORDER.

WILMINGTON, DEL., Jan. 11, 1901.

Pay to the order of Walter G. Thomas,

Twenty-five Dollars 26 cents. *25 Dollars 26 cents.*

To the Postmaster at
Baltimore, Md.

WILLIAM T. BLANK,
Postmaster.

Received Payment,

WALTER G. THOMAS.

An **Express Money Order** is an order from one agent of an express company to another to pay a specified sum to the person named in the order.

No. 8. EXPRESS MONEY ORDER.

When countersigned by agent at point of issue, the *United States Express Company* agrees to transmit the sum of Forty-three and $\frac{95}{100}$ Dollars to the order of John Doe.

Dollars	95
43	cents

Name of Remitter,
FRANK BALL.

Countersigned,
E. R. HANNUM,

Date, June 14, 1901.

Agent at Wilkesbarre, Pa.

A **Draft** is an order from one party, usually a bank, or a mercantile house, to another, for the payment of money to a person named or to his order.

No. 9. A DRAFT.

Second National Bank of Wilkesbarre.

\$ 200 $\frac{00}{100}$.

WILKESBARRE, PA., Jan. 12, 1901.

At sight, pay to the order of James Hartman, Two Hundred and $\frac{00}{100}$ Dollars.

To the Third National Bank,
New York.

WILLIS JOHNSON,
Cashier.

BANK DISCOUNT

LESSON 62

A **Bank** is an institution incorporated chiefly for the purpose of loaning money and receiving deposits. National banks, under the direction of the national government, furnish a paper circulation.

To obtain money from a bank it is customary for a man to present a note, either made or indorsed by himself, payable at the expiration of some definitely fixed period of time, usually 30 da., 60 da., or 90 da.

The bank will give him for it a sum equal to the face of the note less the interest for the time named in the note, or in some states for 3 da. more than that time.

Thus, if a man presents a note for \$600 at a bank for discount, for 30 da., at 6%, the bank will deduct the interest for 30 da., at 6%, which is \$3, and return to him the difference, or \$597. The \$3 is called **Bank Discount**, and \$597 the **Proceeds**. In a state where days of grace are allowed, the bank will deduct the interest for 33 da. at 6%, viz., \$3.30, and return as proceeds \$596.70.

Bank Discount is simple interest computed on the face of the note from the day it is discounted to the time of its maturity. Bank discount is always paid in advance.

The **Proceeds** of a note is the sum left after the bank discount has been deducted.

Days of Grace are three days allowed by law in some states for the payment of a note after it becomes due. When no grace is allowed, a note is legally due, or at maturity, at the end of the time named in the note; but

when grace is allowed, it is legally due on the last day of grace.

See page 84 for list of states allowing days of grace.

When a note matures on a Sunday or on a legal holiday, in most states it must be paid on the preceding day.

If a note is not paid when it becomes legally due, a formal declaration, called a **Protest**, is made by a notary public, giving legal notice to the maker and indorsers that the note has not been paid.

When the time of a note is expressed in days, the day of maturity, in states where grace is allowed, is ascertained by counting forward from the date of the note three days more than the number of days named in the note. Thus, a note for 60 da., dated Nov. 14, matures 63 da. after Nov. 14, or Jan. 16. When the time is expressed in months, the day of maturity is ascertained by counting forward the number of calendar months named in the note, and adding three days of grace. Thus, a note for 4 mo., dated Aug. 30, matures 4 mo. and 3 da. after Aug. 30, or Jan. 2.

The **Term of Discount** is the time for which the note is discounted. It is reckoned from the day the note is discounted to the day of maturity. In some states the day of discount and the day of maturity are both counted. Hence, a 30-da. note in these states would be discounted for 31 da. or 34 da.

In this book the day of maturity alone is reckoned.

LESSON 63

J. M. Burdick bought a horse from T. J. Rudolph for \$250. He paid \$150 cash, and gave Rudolph his note for the balance, \$100, payable in 90 da., without interest. The note was indorsed by James Egan.

Following is the note :

\$100.

WILKESBARRE, PA., Dec. 17, 1900.

Ninety days after date, for value received, I promise to pay T. J. Rudolph, or order, One Hundred Dollars, without interest.

J. M. BURDICK.

Mr. Rudolph, needing money, took the note, the same day he received it, to the Wyoming National Bank for discount. The bank officials, considering the maker, payee, and indorser able to pay the note when due, accepted it, calculated the interest on its face value, \$100, for 90 da., at 6%, subtracted it from \$100, and gave Mr. Rudolph the difference.

1. How much did Mr. Rudolph receive for the note?
2. How much did the bank retain for discounting the note?
3. Who is the maker in the above note? The payee? The indorser?

When a note is discounted, the payee must indorse it on the back to the order of the party who discounts it. Mr. Rudolph wrote on the back of the preceding note :

Pay to the order of the Wyoming National Bank.

T. J. RUDOLPH.

This makes Mr. Rudolph responsible with Mr. Burdick and Mr. Egan for the payment of the note.

4. What is the date of the preceding note? When is it due? (Count forward 90 da. from date of note. See Lesson 62.)

5. Had Mr. Rudolph kept the note 10 da. before he presented it to the bank for discount, what would have been the *term of discount*? The bank discount? The proceeds?

6. To whom should Mr. Burdick pay this note when it is due? How much should he pay?

7. If the note is not paid when due, a legal notice is served on the maker and indorsers of the note that it has not been paid. What is this notice called? By whom is it served?

Notes intended for discount are usually non-interest bearing notes.

LESSON 64

Find date of maturity, term of discount, discount, and proceeds.

1.

\$300.

SHREWSBURY, PA., Nov. 15, 1900.

Sixty days after date, for value received, I promise to pay Warren Graver, or order, Three Hundred Dollars.

WILLIS BONNER.

Discounted Dec. 1, at 6%.

OPERATION

Date of maturity, Jan. 14, 1901. Term of discount, 44 da. *Ans.*

$$\$300 \times .06 \times \frac{44}{360} = \$2.20, \text{ discount.}$$

$$\$300 - \$2.20 = \text{proceeds. } \textit{Ans.}$$

The date of maturity, Jan. 14, is found by counting forward 60 da. from Nov. 15. Deducting from 60 da. the 15 da. remaining in November, we have 45 da. left. Deducting 31 da., December, from 45 da., we have left 14 da., which is the date of maturity.

The term of discount, 44 da., is found by counting the number of days from Dec. 1 to, and including, Jan. 14. Counting 30 da. in December and 14 da. in January, we have 44 da., the term of discount.

2.

\$3600.

DETROIT, MICH., Oct. 5, 1900.

Sixty days after date, for value received, I promise to pay Hiram Crocker, or order, Thirty-six Hundred Dollars.

JOHN ABNER.

Discounted Oct. 16, at 6%. Allow days of grace.

3.

\$980.

NEW COLUMBUS, PA., May 10, 1901.

Ninety days after date, for value received, I promise to pay Edward Wilton, or order, Nine Hundred Eighty Dollars.

ISAAC NEWHOUSE.

Discounted June 5, at 6%.

4.

\$386 $\frac{50}{100}$.

ELMIRA, N. Y., April 1, 1900.

Ninety days after date, for value received, I promise to pay Jason Branning, or order, Three Hundred Eighty-six and $\frac{50}{100}$ Dollars.

THOMAS GUTHRIE.

Discounted April 10, at $5\frac{1}{2}\%$.

LESSON 65

1.

\$570.

VICKSBURG, MISS., May 10, 1900.

Four months after date, for value received, I promise to pay John Markey, or order, Five Hundred Seventy Dollars.

EDWARD LANIUS.

Discounted June 1, at 7%. Allow days of grace.

OPERATION

Due Sept. 13. Term of discount, 104 da.

$$\$570 \times .07 \times \frac{104}{360} = \$11.526, \text{ discount.}$$

$$\$570 - \$11.526 = \$558.474, \text{ proceeds. } \textit{Ans.}$$

The date of maturity is found by counting forward 4 calendar months from May 10, and adding 3 da. of grace. The term of discount is found by counting the number of days from the day of discount to, and including, the day of maturity, as in the preceding examples.

2.

\$790.

GLEN ROCK, PA., June 20, 1900.

Five months after date, for value received, I promise to pay Nathan Bowers, or order, Seven Hundred Ninety Dollars.

HUGH DAY.

Discounted Sept. 5, at 8%.

3.

\$386 $\frac{40}{100}$.

NEW ORLEANS, LA., Aug. 8, 1900.

Six months after date, for value received, I promise to pay William Clapham, or order, Three Hundred Eighty-six and $\frac{40}{100}$ Dollars.

JOHN GROVE.

Discounted Sept. 20, at 6%. Allow days of grace.

LESSON 66

When a note bears interest, the discount is reckoned on the amount of the note at maturity.

1.

\$800.

YORK, PA., Nov. 23, 1900.

Three months after date, for value received, I promise to pay Frank Hopper, or order, Eight Hundred Dollars, with interest at 6%.

JOHN HANSON.

Discounted Dec. 25, at 6%.

OPERATION

Time = 3 mo.

$$(\$800 \times .06) \div 12 = \$4 = \text{int. for 1 mo.}$$

$$(\$4 \times 3) + \$800 = \$812, \text{ amt. of note at maturity.}$$

Due Feb. 23. Term of discount, 60 da.

$$\$812 \times .06 \times \frac{60}{360} = \$8.12, \text{ discount.}$$

$$\$812 - \$8.12 = \$803.88, \text{ proceeds. } Ans.$$

2.

\$690.

DAYTON, OHIO, Dec. 18, 1900.

Four months after date, for value received, I promise to pay Charles Dodson, or order, Six Hundred Ninety Dollars, with interest at 6%.

JOHN VOIGHT.

Discounted Jan. 1, 1901, at 6%.

3. A note for \$640, dated March 21, for 3 mo., was discounted March 25, at 6%. Find the discount. Allow days of grace.

Due June 24. Term of discount, 91 da.

STATEMENT

$$\$640 \times .06 \times \frac{91}{360} = \text{discount.}$$

4. A note for \$765, dated Feb. 3, for 4 mo., was discounted the day it was drawn at 5%. Find proceeds.

5. A note for \$3860, dated July 5, for 90 da., was discounted 7 da. after date, at $5\frac{1}{2}\%$. Find the discount.

6. A note for \$8365, dated Aug. 10, for 4 mo., was discounted Sept. 1, at 6%. Find the proceeds.

7. A note for \$9000, dated March 23, for 60 da., was discounted 3 da. after it was drawn, at 5%. Find the proceeds.

8. A note for \$386.60, dated Jan. 1, for 6 mo., was discounted April 1, at 6%. Find the proceeds.

9. A note for \$500, dated June 14, for 120 da., was discounted June 17, at 8%. Find the proceeds.

10. A note for \$300, dated Oct. 12, for 60 da., with interest at 6%, was discounted Oct. 15, at 6%. Find the proceeds.

Due Dec. 11. Term of discount, 57 da.

STATEMENT

$(\$300 \times .06 \times \frac{57}{360}) + \$300 = \text{amount} = \text{sum to be discounted.}$

$\text{Amount} - (\text{amount} \times .06 \times \frac{57}{360}) = \text{proceeds.}$

11. A note for \$875.60, dated Sept. 7, for 90 da., with interest at 5%, was discounted Sept. 20, at 6%. Find the proceeds. (Statement.)

12. A note for \$960.50, dated Dec. 9, 1900, for 3 mo., with interest at $4\frac{1}{2}\%$, was discounted Dec. 24, at 6%. Find the proceeds. (Statement.)

13. A note for \$680.75, dated Oct. 29, 1900, for 4 mo., with interest at 6%, was discounted Nov. 10, at 8%. Find the proceeds. (Statement.)

14. A note for \$7640, dated Oct. 30, 1900, for 4 mo., with interest at 6%, was discounted Oct. 31, 1900, at $6\frac{1}{2}\%$. Find the proceeds. (Statement.)

LESSON 67

1. For what sum must a 60-day note, without interest, be drawn, so that when discounted at bank at 6% it will yield \$594 proceeds?

OPERATION

$\$1.00 \times .06 \times \frac{60}{360} = \$.01$, discount on \$1 for 60 da.

$\$1.00 - \$.01 = \$.99$, proceeds of \$1 for 60 da.

$\$594 \div \$.99 = 600$. \$600 *Ans.*

2. Find the face of a 30-da. note that will yield \$1200 when discounted at 6%.

3. Find the face of a 60-da. note that will yield \$800 when discounted at 8%.

4. Find the face of a 3-mo. note that will yield \$630.46 when discounted at $7\frac{1}{2}\%$.

5. Find the face of a 6-mo. note that will yield \$1384 when discounted at 8%.

6. For what sum must a note payable in 6 mo. 15 da. be drawn so that if discounted at 8% it will give \$6520 proceeds?

7. For what sum must a 90-da. note be drawn so that when discounted at 8% it will yield \$825 proceeds?

8. A merchant bought goods for \$1000 cash and sold them immediately for \$1140, receiving in payment a 6-mo. note, without interest, which he had discounted at bank at 8%. What was his gain?

9. I owe \$1350.52, which I wish to pay. To raise the amount I have a 30-da. note for \$960 discounted at 6%, and the remainder I borrow from bank on a 60-da. note discounted at 8%. Find the face of the second note.

10. If the discount on a 60-da. note at 6% is \$127.26, what is the face?

REVIEW WORK

LESSON 68

1. Change $\frac{3}{4}$ wk. to integers of lower denominations.
2. One parallel side of a trapezoid is 80 yd. The other side is 20% longer, and the perpendicular distance between them is 60 yd. Find the area.
3. What principal will give an amount of \$1005.196 in 2 yr. 8 mo. 27 da., at 6%?
4. Draw an isosceles triangle. Scale $\frac{1}{4}$ in. to 5 yd. Find its area.
5. Draw an equilateral triangle. Scale $\frac{1}{2}$ in. to 10 rd. Find its area.
6. A man placed \$650 at simple interest for his son when he was 12 yr. 6 mo. 21 da. old. How much will he receive when he becomes 21 yr. old, reckoning interest at 6%?
7. How much money must a man put at interest at 6% to have an income of \$72 a month?
8. A piece of ground 360 ft. long, 240 ft. wide, is inclosed by a tight board fence 5 ft. high. How much will it cost to paint the outside at 5¢ a square yard?
9. How many years will it take \$800 to gain \$230, at 5%?
10. What is latitude? Longitude? A solid? A prism?

11. Write a demand note, supplying the necessary data.
12. Write a time note for \$300, due in 3 mo., at $4\frac{1}{2}\%$.
13. How does a time note differ from a demand note?
14. How many degrees of longitude near the equator equal 553.28 mi.?
15. Duties are of how many kinds? Define each kind.
16. What are ports of entry? Customhouses?
17. Name at least three cities at which goods are imported.
18. A piece of muslin measured with a yardstick that is $\frac{1}{2}$ in. too short measures 40 yd. Find its true length.
19. What is insurance? Define policy. Premium.

LESSON 69

1. The longitude of A is 95° west of B. When it is 1.30 P.M. at B, what time is it at A?
2. How long will it take a train to go 144 mi., at the rate of 60 mi. in 1 hr. 20 min.?
3. I spent 5% of $\frac{5}{8}$ of my money for coffee, at 29¢ a pound, and received 80 lb. How much money had I at first?
4. 40% more than $60\frac{1}{2}$ is what number? 40% less than $60\frac{1}{2}$ is what number?
5. $4\frac{1}{2}$ equals how many twentieths?
6. A piece of land containing 1 acre is $13\frac{1}{3}$ rd. long. What is its width?
7. Walter Johnson, 40 yr. old, took out an insurance policy for \$5000, on the ten-year endowment plan, at \$87.20 per \$1000. How much more will he receive at

the end of ten years than the sum of the premiums he has paid?

8. A note of \$650, dated Nov. 14, 1900, and payable in 90 da., without interest, was discounted at bank Dec. 14, 1900, at 6%. When does this note mature? How much is due then? How much does the bank pay for the note? If the note had been payable with interest at 6%, how much would the bank have paid for it?

9. A man wishes to build a fence around a piece of land 48 ft. by 126 ft. How much will the posts cost him at 18¢ apiece, if they are set 6 ft. apart?

10. What is the area of a rhombus, the base being 15 chains and the altitude 10 chains?

11. What is the altitude of a rhombus if the area is 1 acre and the base 24 rd.?

LESSON 70

1. How many bushels of corn will weigh as much as 140 bu. of wheat?

2. The weight of a bushel of corn is what part of the weight of a bushel of wheat?

3. The weight of a bushel of wheat is what per cent of the weight of a bushel of corn?

4. A cubic foot of water weighs $62\frac{1}{2}$ lb. If pine wood is $\frac{2}{3}$ as heavy as water, what is the weight of $1\frac{1}{2}$ cords of pine wood? If pine wood is $\frac{2}{3}$ as heavy as oak wood, how much will a pile of oak wood weigh that contains 1 cd. 18 cu. ft.?

5. If granite is $2\frac{2}{3}$ times as heavy as water, what is the weight of a block of granite 4 ft. long, 3 ft. wide, and 2 ft. thick?

6. Find the amount of \$1750.96 from Dec. 19, 1896, to Feb. 28, 1901, at 6%, reckoning interest by the exact method.

7. At what rate will a principal triple itself at simple interest in 12 yr.?

8. How long will a firkin (56 lb.) of butter last a family if they use $2\frac{2}{3}$ lb. every 3 da.?

9. The ratio of 6 to 18 equals the ratio of 3 to what number?

10. In a mixture of grain containing 4 bu. of corn and 6 bu. of oats, what per cent of the mixture is corn? What per cent is oats?

11. The ratio of 7 to $3\frac{1}{2}$ equals the ratio of $12\frac{1}{4}$ to what number?

12. Mr. Benscoter paid 60% of his money for 180 acres of land; had he paid \$150 more, he would have paid $\frac{5}{8}$ of his money. Find the cost of the land per acre.

LESSON 71

1. A speculator bought 800 bbl. of flour at \$5.25 a barrel, and sold it immediately at \$5.30, receiving in payment a 60-da. note, which he had discounted at bank at 8%. Did he gain or lose, and how much?

2. If \$87.50 is the premium paid for insuring property worth \$7000, what is the rate?

3. How much money must I invest at 5% to bring me an income of \$2.50 a day throughout the year 1901?

4. A lady paid \$27 for a coat. If $66\frac{2}{3}\%$ of the cost of the coat was $\frac{2}{10}$ of what she paid for a dress, how much did she pay for both?

5. A merchant's selling price is 20% above cost. If he allows his customer a discount of 5% on his bill for cash, what is the merchant's profit?

6. A merchant purchased a lot of canned fruits the list price of which was \$1750. How much did they cost him if he was allowed a discount of 20% and $12\frac{1}{2}\%$?

7. What is interest? Bank discount? Trade discount? Insurance? Taxes? Commission?

8. Make an original problem in commission. In bank discount. In trade discount. In insurance. Solve each problem you have made.

9. 36 is 1% of what number? $\frac{1}{2}\%$ of what number? $\frac{3}{4}\%$ of what number?

10. If John can do $\frac{5}{18}$ of a piece of work in a day, in what time can he do 50% of it?

LESSON 72

1. A merchant sold 48 yd. of carpet at \$1.87 $\frac{1}{2}$ a yard, and thereby gained \$19.20. How much did the carpet cost him a yard?

2. The ratio is $3\frac{1}{2}$; the antecedent $\frac{5}{18}$. What is the consequent?

3. By selling coal at \$6 a ton I gain 20%. What per cent should I gain by selling it at \$6.25 a ton?

4. How many times will a wheel $8\frac{7}{12}$ ft. in circumference turn in going $25\frac{3}{4}$ mi.?

5. Find the duty on 150 doz. pairs linen cuffs, at 30¢ a dozen pairs, and 15% ad valorem, if the cuffs cost 20¢ a pair.

6. State the necessary steps a man must take to borrow money from a bank.

7. A dealer imported from France 500 doz. pairs of gloves for which he paid 5 francs a pair. The specific duty was \$2.25 a dozen pairs, and ad valorem duty 50%. How much did the gloves cost him in United States money, allowing a franc to equal \$.193?

8. What number increased by $87\frac{1}{2}\%$ of itself equals 168.75?

9. What per cent of 36 is 4? What per cent of 4 is 36?

10. What per cent of : $\frac{2}{3}$ is $\frac{1}{6}$? $\frac{2}{3}$ is .2? $\frac{5}{7}$ is $\frac{3}{7}$? $\frac{3}{4}$ is $6\frac{3}{4}$? .05 is .5?

11. I bought goods at $\frac{1}{5}$ and $12\frac{1}{2}\%$ off the list price and sold them at list price. What was the per cent of gain?

12. The cost of insuring 90% of the value of a cargo of grain at 2.8% was \$131.04. Find the value of the cargo.

13. If $2\frac{1}{2}$ lb. of beefsteak cost \$.35, how much do 5 lb. 4 oz. cost?

14. I sold a horse for \$184, which was at a gain of 15%. Had I sold him for \$140, what would have been the loss per cent?

15. A grocer bought 3 bu. of chestnuts at 4¢ a quart and sold them at 40¢ a peck. How much did he gain?

16. If $55\frac{5}{8}\%$ of a mill is worth \$5225, what is the mill worth?

17. A man spent 40% and $42\frac{3}{4}\%$ of his money and had \$24 left. How much had he at first?

LESSON 73

1. Find 25% of $\frac{3}{4}$; $\frac{1}{4}\%$ of $\frac{1}{2}$; 150% of $\frac{1}{2}$; $33\frac{1}{3}\%$ of $\frac{1}{20}$ of a ton.

2. What fraction of a week is 1 da. 18 hr.? What per cent?

3. Divide 6 cu. yd. 20 cu. ft. 72 cu. in. by 5.
4. Subtract 40 cu. yd. 20 cu. ft. 425 cu. in. from 81 cu. yd. 3 cu. ft. 208 cu. in.
5. Mr. Phillips paid \$103.60 premium for insuring $\frac{1}{4}$ of the value of a tape factory, at $2\frac{1}{3}\%$, and \$117 premium for insuring 75% of the value of the stock, at $2\frac{1}{2}\%$. Find the entire value of the property.
6. If in an alloy of 63 oz. of silver and gold there are 28 oz. of silver, what per cent of the whole is each?
7. After spending \$23 for a suit of clothes, a boy had \$184. What per cent of his money did he spend?
8. Silk that cost \$1.50 a yard was marked to be sold at \$2 a yard. Before selling it was reduced 10%. What was the gain per cent?
9. When you borrow money at a bank do you receive the sum of money named in the note you give the bank? What sum will you receive if you give a bank your note for \$500, due in 60 da., the rate of discount being 6%? How much will the bank make by the transaction?
10. How do bank discount and interest differ? In Example 9 what sum has the bank invested in the note? Does the bank realize more or less than 6% on its investment?
11. How many 2-in. cubes are there in a block of wood 4 ft. long, 28 in. wide, and 18 in. thick?
12. How many gallons will a cistern 6 ft. square and 4 ft. deep hold? Allow $7\frac{1}{2}$ gal. to 1 cu. ft.
13. Give the dimensions of a vessel having a rectangular base that will hold 1 gal. (231 cu. in.).
14. If the radius of a circle is 8 in., how long is the circumference?

EXCHANGE

LESSON 74

Exchange is a method of making payments to persons living at a distance.

A man may pay a debt in a distant place, without the transmission of money, by means of a *check*, a *postal money order*, an *express money order*, or a *draft*. (See Lesson 61, Nos. 6, 7, 8, and 9.)

Suppose Henry Wilson of Cincinnati owes James Tyler of Baltimore \$100, which he wishes to pay.

He can purchase a *postal money order* at the Cincinnati post office, or an *express money order* at any express office, and send it to Mr. Tyler.

Or, if he has money deposited in any bank, he can send Mr. Tyler a check. But he decides to send a draft. So he goes to a bank, and buys a draft for \$100, like the following, and sends it to Mr. Tyler:

NO. 426. FIRST NATIONAL BANK OF CINCINNATI

\$100 $\frac{00}{100}$.

CINCINNATI, O., Jan. 14, 1901.

At sight, pay to the order of James Tyler One Hundred Dollars.

WILLIS JOHNSON,

Cashier.

To the Second National Bank, Baltimore, Md.

When Mr. Tyler receives this draft, he will write his name on the back, and present it at the Second National Bank for payment.

Banks usually charge a small fee for their services; about $\frac{1}{8}\%$ of the face value is charged.

1. How much did the preceding draft cost Mr. Wilson?

The party who directs payment to be made and signs the draft is called the *maker* or *drawer*; the party to whom the draft is addressed is called the *drawee*; the party to whose order the draft is made payable is called the *payee*.

2. Who is the *maker* or *drawer* of the preceding draft? Who is the *drawee*? the *payee*?

LESSON 75

The prices of drafts fluctuate according to the demand, or as money is plentiful or scarce.

For example, if the banks of New York do not have money enough on deposit in Chicago to pay the drafts they are making upon Chicago, they must forward money by express to pay them.

To meet this expense banks charge a certain per cent for drafts on Chicago. Drafts in New York on Chicago are then said to be at a premium. On the other hand, if the New York banks have large sums of money in Chicago, and are in need of money at home, they will sell drafts on Chicago at a discount to encourage their purchase so that they may obtain money to use at home.

1. Find the cost of a draft for \$ 600, at $\frac{1}{4}\%$ premium.

OPERATION

$$\text{\$ } 600 \times .00\frac{1}{4} = \text{\$ } 1.50, \text{ premium.}$$

$$\text{\$ } 600 + \text{\$ } 1.50 = \text{\$ } 601.50, \text{ cost. } \textit{Ans.}$$

2. Find the cost of a draft for \$ 800, at $\frac{3}{8}\%$ premium.
3. Find the cost of a draft for \$ 605.50, at $\frac{1}{5}\%$ premium.
4. Find the cost of a draft for \$ 1080, at $\frac{1}{4}\%$ premium.
5. Find the cost of a draft for \$ 1500, at $1\frac{1}{4}\%$ discount.

OPERATION

$$\$1500 \times .01\frac{1}{4} = \$18.75, \text{ discount.}$$

$$\$1500 - \$18.75 = \$1481.25, \text{ cost. } \textit{Ans.}$$

6. Find the cost in New York of a draft on Denver for \$346.80, at $\frac{1}{2}\%$ discount.

7. Find the cost of a draft for \$960 on Cincinnati at $\frac{5}{8}\%$ discount.

LESSON 76

The drafts which we have considered are called **Sight Drafts**, because they are payable when presented. There is another form used, sometimes called **Time Drafts**, payable a certain number of days after sight or after date. Time drafts in some states are allowed three days of grace.

NOTE.—In this book days of grace are not allowed on time drafts unless specified.

When a time draft is presented to the *drawee*, if he consents to pay it, he writes the word *Accepted*, with the date of acceptance, and his name across the face of the draft. This is called an *acceptance*.

FORM OF TIME DRAFT.

No. 938. Miners' Savings Bank of Scranton.

\$2000 $\frac{00}{100}$

SCRANTON, PA., Jan. 16, 1901.

Ten days after sight pay to the order of John Davis
Two Thousand Dollars.

THOMAS BIGBEE,

TO THE FIRST NATIONAL BANK,
ST. LOUIS.

Cashier.

Since the buyer of such a draft must wait the required time before he can have it cashed by the drawee, it is

evident that such a draft should be purchased at a discount for the time it is to run. When sight drafts are at par, time drafts are worth their face value, less the bank discount for the time to run.

1. Find the cost of a 30-da. draft for \$500, exchange being at $\frac{1}{4}\%$ premium, and interest 6%.

OPERATION

$$\$500 \times .06 \times \frac{30}{360} = \$2.50, \text{ discount for 30 da.}$$

$$\$500 - \$2.50 = \$497.50, \text{ cost of draft if exchange were at par.}$$

$$\$500 \times .00\frac{1}{4} = \$1.25, \text{ premium.}$$

$$\$497.50 + \$1.25 = \$498.75, \text{ cost. } \textit{Ans.}$$

2. Find the cost of a draft for \$320, at 60 da., premium $1\frac{1}{8}\%$, interest 6%.

3. How much will a 90-da. draft for \$560 cost when exchange is $\frac{5}{8}\%$ premium, and interest 6%?

4. Find the cost of a 90-da. draft for \$3000, at $\frac{3}{8}\%$ premium, and interest at 5%.

5. Find the cost of a 60-da. draft for \$5600, at $\frac{1}{8}\%$ discount. Rate of interest 6%. Allow grace.

OPERATION

$$\$5600 \times .06 \times \frac{63}{360} = \$58.80, \text{ discount for 63 da.}$$

$$\$5600 - \$58.80 = \$5541.20, \text{ cost if exchange were at par.}$$

$$\$5600 \times .00\frac{1}{8} = \$7, \text{ discount.}$$

$$\$5541.20 - \$7 = \$5534.20, \text{ cost. } \textit{Ans.}$$

6. Find the cost of a draft for \$2000, payable in 60 da., when exchange is $\frac{1}{2}\%$ discount, and interest 7%. Allow grace.

7. Find the cost of a draft for \$1000 for 60 da., premium $\frac{3}{4}\%$, and interest 6%.

RATIO AND PROPORTION

RATIO

LESSON 77

1. What is ratio? The antecedent? The consequent?
2. How is the ratio of two numbers found?
3. What is the ratio of 16 to 8? Of 8 to 16? Of $\frac{1}{2}$ to $\frac{1}{4}$? Of $\frac{1}{4}$ to $\frac{1}{2}$? Of $\frac{3}{4}$ to $\frac{1}{2}$? Of $\frac{3}{8}$ to $\frac{3}{4}$?

A **Simple Ratio** is the ratio of one antecedent and one consequent; as, $9 : 3$.

A **Compound Ratio** expresses the product of two or more simple ratios; thus, $4 : 12 \times 5 : 6 = \frac{4}{12} \times \frac{5}{6}$.

4. What is the ratio of 43.2 to 7.2? Of .3 to $2.6\frac{1}{3}$?

Find the value of the following ratios:

$$(4 : 8) \times (7 : 6); (9 : 3) \times (6 : 5); (24 : 3) \times (76 : 28).$$

5. The ratio is 18 and the antecedent 54. Find the consequent.

6. The ratio is $4\frac{1}{2}$ and the antecedent $157\frac{1}{2}$. Find the consequent.

7. The consequent is $24\frac{1}{8}$ and the ratio $\frac{1}{8}$. Find the antecedent.

8. What is the ratio of a square 2 ft. long to a square 1 ft. long?

9. What is the ratio of a 2-in. cube to an inch cube?

10. What is the ratio of a square to another square which is just half as long?

PROPORTION

LESSON 78

When four quantities are arranged so that the ratio of the *first* to the *second* equals the ratio of the *third* to the *fourth*, the four terms form a proportion. Thus, $12 : 4 = 9 : 3$ is a proportion, and is read, the ratio of 12 to 4 equals the ratio of 9 to 3; or, 12 is to 4 as 9 is to 3.

A proportion is often indicated by writing a double colon between the ratios compared. Thus, $12 : 4 :: 9 : 3$.

The first and fourth terms of a proportion are called the **Extremes**, and the second and third the **Means**.

PRINCIPLES. — *The product of the extremes equals the product of the means.*

Either extreme equals the product of the means divided by the other extreme.

Either mean equals the product of the extremes divided by the other mean.

A **Simple Proportion** consists of two simple and equal ratios. Simple proportion was formerly called the *single rule of three*, because three terms are given to find the fourth.

1. Is the ratio of 12 to 3 equal to the ratio of 16 to 4?
2. The ratio of 18 to 3 equals the ratio of 24 to what number? Of 36 to what number?
3. Read $8 : 24 = 12 : 36$; $10 : 5 = 16 : 8$; $\frac{1}{2} : \frac{1}{4} = \frac{1}{3}$ to $\frac{1}{6}$.
4. Name two numbers whose ratio equals the ratio of 27 to 9, and arrange a proportion.
5. Name two numbers whose ratio equals the ratio of 18 to 27, and arrange a proportion.

LESSON 79

Find the omitted term in each of the following :

1. $12 : 6 = 14 : ()$.
2. $16 : 4 = () : 8$.
3. $9 : () = 27 : 9$.
4. $() : 24 = 36 : 72$.
5. $32 : 96 = 30 : ()$.
6. $\$12 : \$30 = () : 190 \text{ bu.}$
7. $\$34 : \$136 = 70 \text{ yd.} : ()$.
8. $() : 1\frac{5}{7} = 1\frac{2}{3} : 1\frac{3}{5}$.
9. $8\frac{3}{4} : 1\frac{1}{4} = 487\frac{1}{2} : ()$.
10. $1 : () = 1.36 : 35.36$.

11. Write a proportion, using the ratios $9 : 22\frac{1}{2}$ and $6 : 15$, and prove that your proportion is a correct one.

12. Is the following a correct proportion $7 : 6 = 9 : 4$? Why not?

13. Write a proportion, using the following quantities : $\$39$, 16 lb. , $\$13$, $5\frac{1}{3} \text{ lb.}$

The first and second terms of a proportion are called the *first couplet*, and the third and fourth the *second couplet*.

14. Construct a proportion in which the antecedent of the first couplet is 24 and the antecedent of the second couplet is 16.

15. Construct a proportion in which the consequent of the first couplet is 20 and the consequent of the second couplet is 30.

16. Write two proportions, using the terms 8, 12, 16, and 24. Test your work by comparing the product of the means with the product of the extremes.

LESSON 80

In stating a problem in proportion, it is most convenient to arrange the quantities so that the required answer will be the fourth term. Therefore, the third term must be of the same kind of quantity as the answer.

1. If 8 bbl. of flour cost \$40, how much will 12 bbl. cost?

Since the *cost* of 12 bbl. is required, we make the given cost, \$40, the third term of the proportion. It is evident that the cost of 12 bbl. will be more than the cost of 8 bbl. Therefore, the greater of the two remaining

STATEMENT

8 bbl. : 12 bbl. = \$40 : answer.

OPERATION

$$(12 \times 40) \div 8 = 60.$$

\$60 Ans.

quantities must be the second term. The reason for this is plain. Since the consequent of the second couplet will be greater than the antecedent, the consequent of the first couplet must also be greater than the antecedent; for the two couplets must represent equal ratios. Dividing the product of the means by the given extreme, we find the other extreme to be 60.

2. If 25 yd. of cloth cost \$75, how much will 15 yd. cost?

Since the answer, or fourth term, will be the cost of 15 yd., we make the given cost, \$75, the third term. From the nature of the problem it is evident that the cost of 15 yd. will be less than the cost of 25 yd.

STATEMENT

25 yd. : 15 yd. = \$75 : answer.

OPERATION

$$(15 \times 75) \div 25 = 45.$$

\$45 Ans.

Therefore, the smaller of the two remaining quantities must be made the second term. Again, the reason for this is obvious. Since the consequent of the second ratio will be less than the antecedent, the consequent of the first ratio must also be less than the antecedent.

After making the third term of the proportion the same kind of quantity as the required answer, the pupil should notice, from the nature of the example, whether the answer (fourth term) is to be greater or less than the third term. If greater, then the greater of the two remaining quantities must be the second term; but if the answer is to be less than the third term, then the smaller of the two remaining quantities must be made the second term.

3. If 14 yd. of silk cost \$42, how much will 56 yd. cost?

4. If a train running 35 mi. an hour completes a certain trip in 8 hr., in what time will a limited express running 45 mi. an hour complete the same trip?

5. If 120 sheep were sold for \$480, how much would 89 sheep bring at the same rate?

6. If 80 tons of coal cost \$220, how much will 124 tons cost?

7. If it requires 200 lb. of coal to run an engine for 6 hr., how many pounds will be consumed by the engine in making 15 trips of 8 hr. each?

8. A man walked 171 mi. 140 rd. in 9 da. At the same rate, how far would he walk in 21 da.?

9. If 154 bu. of wheat are required to make 44 bbl. of flour, how many bushels will be required to make 26 bbl.?

10. If 36 carpenters earn \$416 in one week, in how many days will they earn \$624?

11. If \$840 gains \$.42 in one year, how much will \$945 gain in the same time?

12. If 9 masons build a wall in 24 da., working 8 hr. daily, in what time will they build it working 10 hr. daily?

13. A staff 27 ft. high casts a shadow $18\frac{1}{2}$ ft. What must be the height of a staff to cast a shadow 30 ft. 9 in. at the same time of day?

14. If a ton of iron ore yields .65 of a ton of pure iron, how much iron ore will be required to yield 376.22 tons?

LESSON 81

1. How many barrels, each containing 31.5 gal., will be required to hold 1299.375 gal.?

2. If $13\frac{1}{2}$ tons of iron cost \$582 $\frac{1}{2}$, how many tons will \$2833 $\frac{1}{2}$ buy at the same price?

3. When $53\frac{4}{11}$ bu. of corn are given for $13\frac{1}{15}$ tons of coal, how many bushels must be given for $92\frac{2}{3}$ tons?

4. The cost of reaping 10 A. 140 sq. rd. of grain is \$6.80. At the same rate, what will be the cost of reaping 18 A.?

5. If a force of 1320 laborers clears half the streets of a city of snow in 5 hr., how many extra men must be employed to complete the work in 3 hr. more?

6. If 31 yd. of cloth cost \$76, how much will 18 pieces, each containing $39\frac{1}{2}$ yd., cost?

7. John's money is to Henry's money as 3 is to 7. If Henry's money is \$6000, how much money has John?

8. If the freight on 20 bbl. of flour from New York to Scranton is \$9.60, what will be the freight on 78 bbl.?

9. If an 8-cent loaf weighs 20 oz. when flour is selling at \$5 a barrel, how much should it weigh when flour is selling at \$8 a barrel?

10. A piece of land 40 rd. long and 80 rd. wide contains just 20 A. How long must a lot be to contain 20 A. if its width is 16 rd.?

11. If 80 loaves of bread supply 150 men 9 da., how many loaves will be required to supply 180 men the same time?

12. If 1260 bu. of oats last 46 horses 7 wk., how many horses will 3780 bu. last the same time?

13. A bicycle wheel 72 in. in circumference revolves 880 times in going a mile. How many times will it revolve in going 47,520 ft.?

LESSON 82

Compound Proportion expresses an equality of two ratios, one or both of which always are compound.

$$\text{I. } \left\{ \begin{array}{l} 10 : 6 \\ 12 : 10 \\ 16 : 24 \end{array} \right\} = 4 : 3 \quad \text{II. } \left\{ \begin{array}{l} 8 : 24 \\ 14 : 28 \\ 6 : 24 \end{array} \right\} = \left\{ \begin{array}{l} 10 : 20 \\ 6 : 18 \\ 3 : 12 \end{array} \right\}$$

In the first of the preceding proportions only one ratio is compound ; in the second, both are compound.

1. If 16 men build 12 rd. of wall in 20 da., how many rods will 40 men build in 24 da. ?

Since the required term, or the answer, is to be rods, we make 12 rd. the third term.

It is evident that 40 men will build more wall than 16 men will. Therefore we make 40 men the second term and 16 men the first. More wall will be built in 24 da. than in 20 da. Therefore we make the larger of the two numbers compared (24 da.) the second term, and 20 da. the first.

STATEMENT

$$16 : 40 = 12 \text{ rd.} : \text{answer.}$$

$$20 : 24.$$

OPERATION

$$\frac{40 \times 24 \times 12 \text{ rd.}}{16 \times 20} = 36 \text{ rd.} \quad \text{Ans.}$$

Dividing the product of the second and third terms by the product of the first terms, we get 36 rd. as the answer.

2. If 4 men dig 250 rd. of ditch in 150 da., in how many days will 36 men dig 486 rd. ?

Since the answer is to be days, we make 150 da. the third term. If 4 men do the work in 150 da., 36 men will do it in less time ; hence we make the smaller of the two numbers compared (4 men) the second term, and 36 men the first. Again, it will take more days to dig 486 rd. than 250 rd., hence we make 486 the second term and 250 the first.

STATEMENT

$$36 : 4 = 150 \text{ da.} : \text{answer.}$$

$$250 : 486.$$

OPERATION

$$\frac{4 \times 486 \times 150}{36 \times 250} = 32\frac{1}{2} \text{ da.} \quad \text{Ans.}$$

Dividing the product of the second and third terms by the product of the first terms, we get $32\frac{2}{3}$ da. as the answer.

3. If 36 men cut 360 cords of wood in 5 da. of 10 hr. each, how many cords will 40 men cut in 3 da. of 8 hr. each?

4. If a piece of land 80 rd. long and 40 rd. wide costs \$326, what will be the cost, at the same rate, of a piece 140 rd. long and 80 rd. wide?

5. If 32 yd. of sheeting $2\frac{1}{4}$ yd. wide cost \$7.36, how much will 45 yd. $2\frac{1}{2}$ yd. wide cost?

6. If a block of ice 16 in. long, 12 in. wide, and 10 in. thick weighs 25 lb., how much will a block 30 in. long, 10 in. wide, and 8 in. thick weigh?

7. If 10 joists 30 ft. long, 10 in. wide, and 4 in. thick cost \$14, how much will 60 joists 20 ft. long, 9 in. wide, and $3\frac{1}{2}$ in. thick cost?

8. If \$400 yield \$114 interest in 4 yr. 9 mo., how much interest will \$750 yield in 3 yr. 8 mo. at the same rate?

9. If \$1200, in 9 yr., at 3%, gains \$324 interest, how much will \$2400 gain in 6 yr. 4 mo., at 8%?

10. If \$500 gains \$100 interest in 4 yr., at 5%, what principal will gain \$108 in 3 yr., at 6%?

11. If it requires 21,600 bricks for a wall 80 ft. long, 6 ft. high, and 20 in. thick, each brick being 8 in. long, 4 in. wide, and 2 in. thick, how many bricks 8 in. long, $4\frac{1}{2}$ in. wide, and 2 in. thick will it take to build a wall 100 ft. long, 8 ft. high, and 24 in. thick?

12. If 28 men, working 14 da. of 10 hr. each, dig a cellar 160 ft. long, 40 ft. wide, and 8 ft. deep, in how many days of 8 hr. each will 21 men dig a cellar 120 ft. long, 30 ft. wide, and 10 ft. deep?

LESSON 83

Partitive Proportion treats of the division of a number into parts proportional to certain other numbers.

1. Divide 152 into three parts proportional to 3, 7, and 9.

If 152 is divided into $3 + 7 + 9$, or 19 equal parts, $\frac{3}{19}$ of 152, or 24, will equal the first number, $\frac{7}{19}$ of 152, or 56, will equal the second number, and $\frac{9}{19}$ of 152, or 72, will equal the third number.

OPERATION

$$3 + 7 + 9 = 19.$$

$$\left. \begin{array}{l} \frac{3}{19} \text{ of } 152 = 24, \text{ first number.} \\ \frac{7}{19} \text{ of } 152 = 56, \text{ second number.} \\ \frac{9}{19} \text{ of } 152 = 72, \text{ third number.} \end{array} \right\} \text{Ans.}$$

2. Divide 198 into three parts proportional to 5, 6, and 7.

3. Divide 374 into four parts proportional to 2, 3, 8, and 9.

4. Divide 207 into three parts proportional to $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$.

Since the parts are to be to each other as $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$, or $\frac{6}{12}$, $\frac{8}{12}$, and $\frac{9}{12}$, or 6, 8, and 9, if we divide 207 into $6 + 8 + 9$, or 23 equal parts, 6 of these equal $\frac{6}{23}$ of 207, or 54, will equal the first part, $\frac{8}{23}$ of 207, or 72, will equal the second part, and $\frac{9}{23}$ of 207, or 81, will equal the third part.

OPERATION

$$\frac{1}{2} = \frac{6}{12}; \frac{2}{3} = \frac{8}{12}; \frac{3}{4} = \frac{9}{12}.$$

$$6 + 8 + 9 = 23.$$

$$\left. \begin{array}{l} \frac{6}{23} \text{ of } 207 = 54, \text{ first number.} \\ \frac{8}{23} \text{ of } 207 = 72, \text{ second number.} \\ \frac{9}{23} \text{ of } 207 = 81, \text{ third number.} \end{array} \right\} \text{Ans.}$$

5. Divide \$819 into three parts proportional to $\frac{1}{4}$, $\frac{2}{5}$, and $\frac{3}{7}$.

6. Three men gained \$4800 on a joint investment. Find each man's share of the gain if their respective investments were proportional to 7, 8, and 9.

7. A man divided 434 acres of land between his two sons so that their respective shares were proportional to $\frac{3}{4}$ and $\frac{5}{6}$. How many acres did each receive?

8. A miller invested \$5776 in wheat, corn, and rye in parts proportional to 3, 5, and 8. Find how much was invested in each kind of grain.

9. A farmer shipped to market a car load of corn and rye containing 468 bu. in parts proportional to $\frac{1}{6}$ and $\frac{1}{8}$. Find the number of bushels of each.

10. Divide \$3203.20 among three men so that their shares shall be proportional to $\frac{7}{12}$, $\frac{5}{8}$, and $1\frac{1}{6}$.

11. Three brothers raised 31,620 bu. of potatoes. How many bushels did each raise if their amounts are to each other as 9, 10, and 12?

12. Three partners divided \$37,640 profits among themselves in the proportion of 4, 7, and 9. What was the share of each?

13. Divide 810 into five parts which shall be to each other as 1, 2, 3, 4, and 5.

14. Divide 1936 into three parts which shall be to each other as $2\frac{1}{2}$, $1\frac{0}{3}$, and $4\frac{1}{4}$.

15. Coffee is sometimes mixed in the ratio of 3 lb. of Java to 1 lb. of Mocha. Find the amount of each kind in a mixture of 240 lb.

AREAS

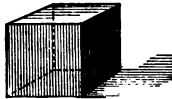
LESSON 84

A **Prism** is a solid whose sides are parallelograms, and whose ends or bases are equal polygons parallel to each other.

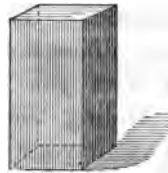
A prism is named from the form of its base as *triangular*, *square*, *quadrangular*, *pentagonal*, etc.



TRIANGULAR
PRISM

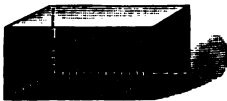


SQUARE
PRISM



QUADRANGULAR
PRISM

PARALLELOPIPEDON,
or



RECTANGULAR
PRISM



PENTAGONAL
PRISM

The **Convex** or **Lateral Surface** of a prism is the area of its parallelograms taken together.

1. Examine the triangular prism above and tell what plane figures are represented by the sides.
2. What plane figures are represented by its ends or bases ?

3. How many parallelograms form its lateral surface?
4. If the height of the prism is 8 in., and each side of the triangles forming the ends measures 4 in., state the dimensions of each lateral face, or parallelogram.
5. What is the area of one parallelogram? What is the convex surface of the prism?
6. If the three parallelograms forming the convex surface of the prism are placed side by side, what plane figure will they form? ($ABCD$, Fig. 1.)
7. The perimeter of the base forms which dimension of the rectangle? The height forms which dimension?

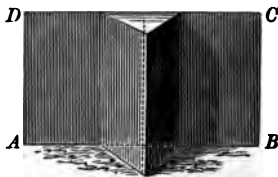


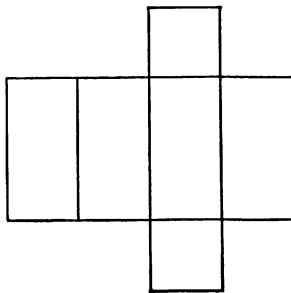
FIG. 1

8. Can you formulate a rule for finding the convex surface of a triangular prism?
9. Can your rule for finding the convex surface of a *triangular* prism be applied in finding the convex surface of *any* prism?

LESSON 85

1. Find the convex surface of a triangular prism $4\frac{1}{2}$ ft. high, each side of its base being 2 ft. The diagram at the right shows the entire surface of a quadrangular prism, drawn on a scale of $\frac{1}{4}$ in. to 2 ft.

2. What is the altitude of the prism?
3. What is the perimeter of its base?
4. What is the convex surface of the prism?



5. What must be added to the convex surface in order to get the *entire* surface?

6. What is the area of both ends or *bases*?

7. What is the *entire* surface of the prism?

8. Can you formulate a rule for finding the entire surface of a quadrangular prism?

9. Can your rule be applied in finding the entire surface of any prism?

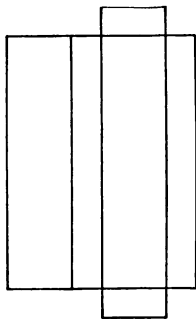
10. Draw on paper a diagram to show the entire surface of a quadrangular prism whose altitude is 2 ft., and whose ends are 2-in. squares. Cut it out from the paper, fold it in proper form, and get the entire surface.

11. Find the entire surface of a 6-in. cube. Make a diagram. Scale $\frac{1}{8}$.

12. Find the entire surface of an 8-ft. cube. Make a diagram $\frac{1}{4}$ in. to the foot.

13. The diagram shows the entire surface of a parallelopipedon or rectangular prism, drawn on a scale of $\frac{1}{8}$ in. to 2 ft. Find the entire surface.

14. Make a diagram to show the entire surface of a rectangular prism 8 in. high, 6 in. by 4 in. Scale $\frac{1}{2}$.

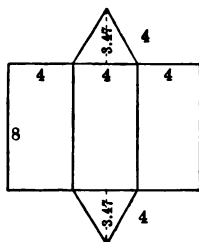


LESSON 86

1. Find the area of a prism 8 ft. by 6 ft. by 4 ft.

2. Find the area of a prism 9 ft. by $4\frac{1}{2}$ ft. by $3\frac{1}{2}$ ft.

The form at the right is a diagram of the entire surface of a triangular prism. The figures indicate the size in feet.



3. What is the altitude of the prism?

4. What is the perimeter of its base?

5. What is the convex surface of the prism?

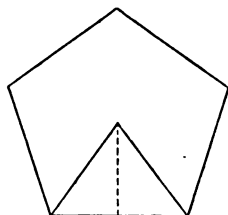
6. What must be added to the convex surface in order to get the entire surface?

7. How do you find the area of a triangle?

8. What is the entire surface of the prism?

9. Find the convex surface of a triangular prism 20 in. high, the bases being isosceles triangles whose sides are 10 in., 10 in., and 16 in.

10. The figure at the right is a regular pentagon, drawn on a scale of $\frac{1}{8}$ in. to 1 ft. Find by measurement its area. Consider this pentagon the base of a prism 12 ft. high. What is its entire surface?



11. Find the convex surface of an octagonal prism whose sides are each 4 ft., and altitude 20 ft.

12. Find the entire surface of a block of stone 16 in. long, 8 in. wide, and 8 in. thick.

13. How much will it cost to cement a cellar floor 50 ft. long and 20 ft. wide, at 30¢ a square yard?

14. How many square feet of zinc will be needed to line the sides and bottom of a tank 8 ft. 6 in. long, 6 ft. 3 in. wide, and 5 ft. deep?

15. Find the area of a regular octagon one of whose sides is 8 ft., and whose perpendicular distance from its center to any side is 9.65 ft.

LESSON 87

A **Cylinder** is a solid bounded by a uniformly curved surface, having for its bases, or two ends, equal circles parallel to each other.

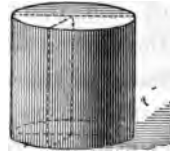


FIG. 1. CYLINDER

1. How does a cylinder differ from a prism?

The convex surface of a cylinder is the area of its curved surface.

2. If a piece of paper is fitted to a cylinder so as to cover its convex surface, and then unrolled, its form will be what plane figure? (See *ABCD*, Fig. 2.)

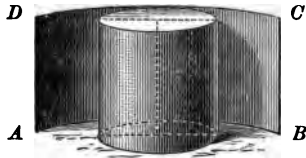


FIG. 2

3. How do you find the area of a rectangle?

4. The length of the rectangle equals which dimension of the cylinder? The width of the rectangle equals which dimension of the cylinder?

5. Can you make a rule for finding the convex surface of a cylinder?

6. Is your rule the same as that for finding the convex surface of a prism?

7. What must be added to the convex surface of a cylinder in order to get the entire surface?

8. Find the convex surface of a cylinder whose circumference is 20 in. and height 10 in.

9. Find the area of the ends of the cylinder described in Ex. 8.

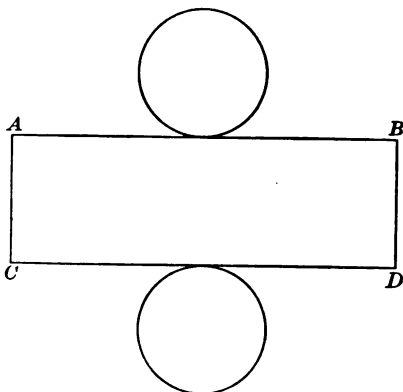
This illustration shows the entire surface of a cylinder.

10. Which two edges of the rectangle join the curved edges of the bases of the cylinder?

11. How does the length of these edges compare with the length of the circumferences of the bases?

12. Which two edges of the rectangle are equal to the distance between the bases of the cylinder?

13. The diagram above is drawn on a scale of $\frac{1}{8}$ of an inch to 1 in. Find the entire surface of the cylinder.



LESSON 88

1. Find the entire surface of a cylinder whose circumference is 15 ft. and height 10 ft.

2. Find the entire surface of a cylinder whose diameter is $5\frac{1}{2}$ ft. and altitude 3 yd.

3. Find the entire surface of a cylinder whose radius is 4 ft. and height 12 ft.

4. Find the entire surface of a cylinder whose altitude is 12 ft. 6 in. and circumference 9 ft.

5. Find the surface of a 6-in. cube.

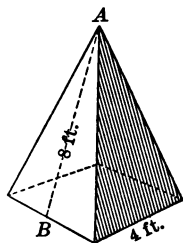
6. The floor of a room 24 ft. long contains $42\frac{2}{3}$ sq. yd. Find the width.

7. The base of a right-angled triangle is 60 ft., and the perpendicular 80 ft. Find its area.

8. Find the surface of a rectangular solid 8 ft. long, 4 ft. wide, and 3 ft. thick.

9. At 20¢ a square yard, how much will it cost to plaster a room 32 ft. long, 28 ft. wide, and 18 ft. high, deducting 1 door 3 ft. by 7 ft. and 3 windows each 3 ft. by 6 ft.?

A **Pyramid** is a solid that has for its base a polygon, and for its sides three or more triangles meeting at a common point called its *vertex*. A pyramid takes its name—triangular, square, pentagonal, etc.—from the shape of its base.



10. What kind of a pyramid is represented by the drawing?

11. How many faces has this pyramid?

12. What is the shape of each face?

13. How do you find the area of a triangle?

14. If the base of each triangle is 4 ft. and the altitude is 8 ft., what is the area of one triangle? What is the convex surface of the pyramid?

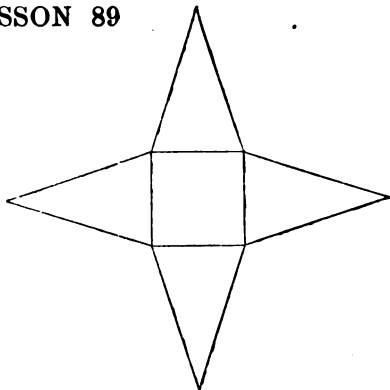
The altitude of any of the triangles forming the convex surface of the pyramid constitutes the slant height of the pyramid; as *AB*.

15. Can you make a rule for finding the convex surface of a pyramid?

16. What must be added to the convex surface in order to get the entire surface of a pyramid?

LESSON 89

This diagram, drawn on a scale of $\frac{1}{2}$ in. to a yard, shows the entire surface of a square pyramid.



1. Find by measurement the perimeter of the base. The slant height.

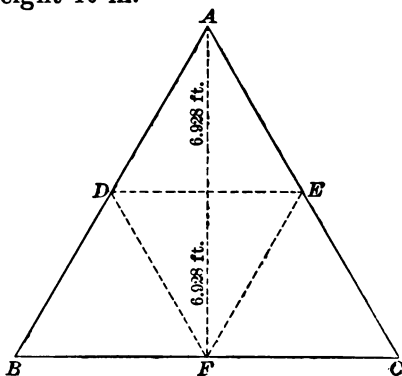
2. What kind of triangles — equilateral, isosceles, or scalene — form the convex surface?

3. Find the entire surface of a square pyramid, the perimeter of whose base is 24 ft. and whose slant height is 12 ft. Make a diagram, using $\frac{1}{4}$ in. to represent 3 ft.

Find the entire surface of the following square pyramids:

4. Base $1\frac{1}{4}$ ft., slant height 2 ft.
5. Base $1\frac{1}{3}$ ft., slant height 3 ft.
6. Perimeter of base $5\frac{1}{3}$ ft., slant height 3 ft.
7. Base 30 in., slant height 40 in.

This figure is a diagram of the entire surface of a triangular pyramid. ABC is an equilateral triangle, each edge being 2 in. long. The middle points of the edges D , E , and F are joined, and the triangle ABC is divided into four smaller equilateral triangles.



8. How many faces has this figure? What is their shape?

9. Why is this figure called a pyramid?

10. Why is it called a triangular pyramid?

11. Has it more than one face which can be called its base?

12. Find the entire surface of the pyramid, regarding the plan to be drawn on a scale of $\frac{1}{8}$ of an inch to the foot,

1st. By calculating the area of each small triangle separately, and then adding.

2d. By calculating the area of the large triangle.

If your answers are the same, your work is correct.

The altitude of the triangles is marked in the diagram.

LESSON 90

This figure represents the entire surface of a pentagonal pyramid.

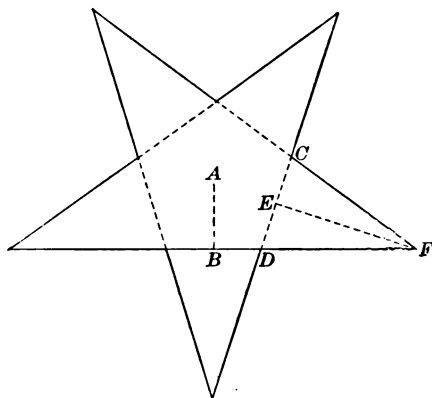
1. How many faces has this figure? What is their shape?

2. Why is this figure called a pyramid?

3. Why is it called a pentagonal pyramid?

4. Calculate the area from the following measurements: $AB = 5$ yd.; $CD = 8$ yd.; $EF = 12$ yd.

5. Find the convex surface of a triangular pyramid whose slant height is 18 ft. and each side of the base 6 ft.



6. What is the entire surface of a pyramid whose base is 40 ft. square and slant height 80 ft? Make a drawing on a scale of $\frac{1}{2}$ in. to 10 ft.

7. Find the entire surface of a square prism, one side of whose base measures 8 in. and whose altitude is 12 in. Make a diagram of the surface on a scale of $\frac{1}{2}$ in. to 4 in.

8. Find the entire surface of a cylinder whose diameter is 4 ft. and altitude 6 ft.

9. What is the area of a trapezium, the length of whose diagonal is 20 ft., and of the perpendiculars from the opposite vertices to the diagonal 5 ft. and 15 ft.?

10. Find the area of a rhomboid whose altitude is 132 ft. and base 154 ft. 3 in.

11. Find the area of a regular octagon one of whose sides is 8 ft., and whose perpendicular distance from the center to any side is 9.656 ft.

12. If you make this octagon the base of a prism whose altitude is 20 ft., what is its entire surface?

13. Make this octagon the base of a pyramid having a slant height of 18 ft., and calculate its entire surface.

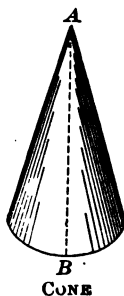
LESSON 91

A **Cone** is a solid that has for its base a circle, and whose convex surface tapers regularly to a point called the vertex.

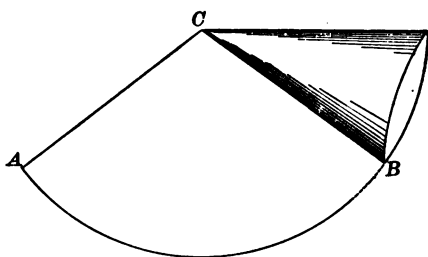
The **Slant Height** of a cone is the distance from the vertex to any point in the circumference of the base, as AB .

It is the only possible case of straight lines on the convex surface of a cone.

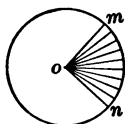
The **Convex Surface** of a cone is all of its surface except the base.



If a piece of paper be fitted to a cone so as to cover exactly its convex surface, and then unrolled, its form will be that of a *sector*, as ABC .



A **Sector** is a part of a circle included by two radii and an arc, as *mon*.



1. The arc AB forms which dimension of the cone?
2. The radius BC forms which dimension of the cone?
3. If the arc AB is 16 in., what is the circumference of the base of the cone?
4. If the radius BC is 9 in., what is the slant height of the cone?
5. Is it true that the area of the sector ABC equals the convex surface of the cone?

Like the whole circle, the sector can be regarded as composed of an infinite number of triangles, whose radius (slant height of a cone) is the altitude, and the sum of whose bases is the arc (the circumference of the base of the cone).

6. Can you formulate a rule for finding the convex surface of a cone?
7. What must be added to the convex surface in order to get the entire surface of the cone?

LESSON 92

1. Find the convex surface of a cone whose slant height is 12 ft. and the circumference of whose base is 20 ft.

2. Find the whole surface of a cone whose slant height is 14 ft. and the diameter of whose base is 10 ft.

3. At 20¢ a square yard, how much will it cost to paint the lateral surface of a cone whose slant height is 16 ft. and the diameter of whose base is 6 ft. ?

4. Find the lateral surface of a cylinder whose altitude is 9 ft. and the diameter of whose base is 4 ft.

5. Find the convex surface of a cone whose slant height is 9 ft. and the perimeter of whose base is 16 ft.

6. Find the convex surface of an octagonal pyramid whose slant height is 9 ft., and each side of whose base is 2 ft.

7. At 25¢ a square yard, how much will it cost to paint the convex surface of a hexagonal steeple, each side of which is 6 ft. and slant height 40 ft. ?

8. Find the entire surface of a square prism whose altitude equals 8 ft. and the side of whose base is $2\frac{1}{2}$ ft.

9. What is a prism ? Why is it a solid ?

10. Define triangular prism; square prism; rectangular prism; pentagonal prism; hexagonal prism.

11. What is the convex surface of a prism ?

12. What is a cylinder ? What is the convex surface of a cylinder ?

13. Give rule for finding the convex surface of a prism. Of a cylinder.

14. How many degrees in a right angle ?

15. An angle of 45° is what part of a right angle ?

16. Define circle ; diameter ; circumference ; radius ; sector ; chord ; arc.

LESSON 93

1. Find the area of a rhomboid with a base $3\frac{1}{2}$ yd. and an altitude 30 in.

2. Find the area of a trapezoid whose parallel sides are 28 in. and 24 in. and altitude $8\frac{1}{2}$ in.

3. At \$35 an acre, find the value of a piece of land one of whose parallel sides is 50 rd. and the other 120 rd., and the perpendicular distance between them 60 rd. Draw a diagram on a scale of $\frac{1}{4}$ in. to 10 rd.

4. The area of a parallelogram is $117\frac{5}{9}$ sq. yd. The distance between its parallel sides is 23 ft. Find the base.

5. It is 125 ft. in a straight line across a circular race track. Find the length of the track.

6. How many yards of canvas will be needed for a tent in the shape of a cone, whose diameter is 14 ft. and slant height 12 ft., if the canvas is 1 yd. wide?

7. Find the entire surface of a cylinder whose diameter at the base is $3\frac{1}{2}$ ft. and altitude 8 ft.

8. A 40-A. field is 160 rd. long. How many rods wide is it?

9. Find the area of a sector of a circle whose radius is 8 ft. and arc 20 ft.

10. Find the convex surface of a triangular prism whose bases are equilateral triangles, each side being 8 in. long, and whose altitude is 12 in.

11. Write the names of nine kinds of polygons; four kinds of parallelograms; three kinds of triangles; three kinds of angles.

12. How many square feet in a board 10 in. wide at one end and 8 in. at the other, if it is 10 ft. 8 in. long?

VOLUMES

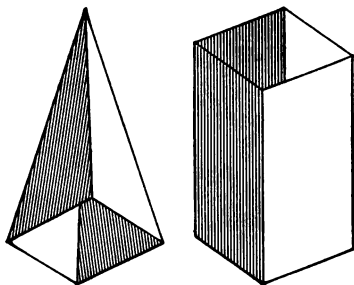
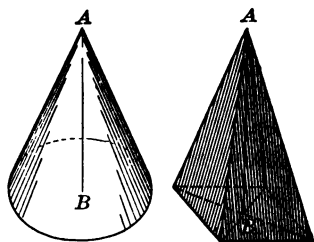
LESSON 94

The **Altitude** of a pyramid or cone is the perpendicular distance from the vertex to the plane of the base, as AB .

The teacher should be certain that the pupils know clearly the distinction between slant height and altitude.

Have the pupils make from cardboard a hollow square prism of convenient size, and a hollow pyramid each having the same base and altitude.

Let the pupil use sand or sawdust—dry sand is the better of the two—to ascertain how many times the prism will contain the contents of the pyramid. If the work is carefully done by the pupils, it will be found that the prism will contain the contents of the pyramid *three times*.



1. Is it true that the volume of a square pyramid equals *one third* of that of a square prism having the same base and altitude?

2. Can you make a rule for finding the volume of a square pyramid?

3. Will your rule hold true in the case of a triangular or any other pyramid?

4. Do you think the relation of the contents of the cone to the contents of a corresponding cylinder is the same as that of the pyramid to the prism?

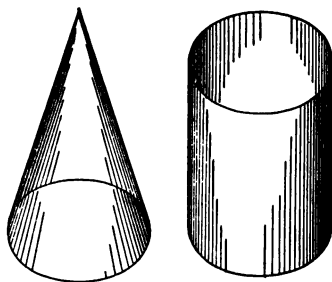
5. Construct a hollow cone and a hollow cylinder of stiff paper or cardboard, and ascertain, by measuring, whether your answer is correct.

6. Make a rule for finding the volume of a cone.

7. Find the volume of a square pyramid each side of whose base is 4 ft. and whose altitude is 12 ft.

8. Find the volume of a square pyramid the perimeter of whose base is 12 ft. and whose altitude is 16 ft.

9. Find the volume of a triangular pyramid the area of whose base is 12 sq. ft. and whose altitude is 10 ft.



LESSON 95

1. Find the volume of a cone the area of whose base is 16 sq. ft. and whose altitude is 14 ft.

2. Find the volume of a cone whose altitude is $16\frac{1}{2}$ ft. and the diameter of whose base is 3 ft.

3. Find the volume of a cylinder whose altitude is $16\frac{1}{2}$ ft. and the diameter of whose base is 3 ft.

4. What is the relation of the answer of the 3d example to that of the 2d example?

5. What is the relation of the volume of a square prism the perimeter of whose base is 16 ft. and altitude 12 ft., to that of a square pyramid whose altitude is 12 ft. and perimeter of whose base is 16 ft. ?

6. Find the entire surface of a cone the radius of whose base is 3 ft. and slant height 25 ft.

7. What is the convex surface of a cone the circumference of whose base is 9 ft. and slant height $4\frac{2}{3}$ ft. ?

8. Find the convex surface of a pyramid whose base is 9 in. square and slant height 6 ft.

9. What part of the volume of a cylinder must be cut away to make a cone having the same base and altitude ?

10. How many square feet of galvanized sheet iron will it take to make 30 ft. of 8 in. pipe ?

11. At $37\frac{1}{2}$ ¢ a square yard, how much will it cost to paint a church spire whose base is an octagon 8 ft. on each side and whose slant height is 75 ft. ?

12. Find the volume of a square pyramid whose altitude is 16 in., each side of the base being 12 in.

13. Find the convex surface of a prism whose length is 6 ft., width 6 ft., and height 8 ft.

14. How many square feet of tin plate will be needed to make a great gross of tomato cans 4 in. in diameter and $5\frac{1}{2}$ in. high, allowing 8 sq. in. for waste in making each can ?

15. What is the volume of a square pyramid each side of whose base is 6 ft. and altitude 12 ft. 6 in. ?

16. What is the convex surface of a square prism each side of whose base is 7 in. and whose altitude is 22 in. ?

17. Find the entire surface of a cone the diameter of whose base is 5 ft. and slant height 24 ft.

REVIEW WORK

LESSON 96

1. If $\frac{3}{8}$ of a lot of goods was sold for $\frac{5}{8}$ of its value, what was the loss per cent?

2. In what time will a principal double itself at 6% simple interest?

3. A merchant sold sugar at 4¢ a pound and thereby lost 12%. Find the cost of the sugar.

4. How long will it take 10 men to do as much work as 2 men can do in $3\frac{1}{2}$ da. of 8 hr. each?

5. A man raised 390 bu. of potatoes in one field, which was 20% more than he raised in another field. How many bushels did he raise in both fields together?

6. A merchant sold goods to the amount of \$1392.25, and received in payment a 90-da. note without interest. At the end of 20 da. he had the note discounted at bank at 6%. How much did he realize from the sale? No grace.

7. On a bill of goods amounting to \$2430, a discount of 10% from the list price was made, and 6% additional was allowed for cash payment. Find the cash value of the goods.

8. A street 2000 ft. long and 25 ft. wide is to be paved with stones $8\frac{1}{2}$ in. long by $4\frac{1}{2}$ in. wide. How many will be required?

9. If 1 man can do a piece of work in $14\frac{2}{5}$ da., how long will it take 6 men to do twice as much work?

10. A farmer sold a storekeeper 30 bu. of potatoes at 50¢ a bushel. Allowing 5 bu. for waste in measuring, etc., for how much per peck must he sell the potatoes in order to realize 20% on the transaction?

LESSON 97

1. An electric car ran from Wilkesbarre to Pittston and returned in $1\frac{1}{2}$ hr. It was 45 min. going and returned at the rate of $13\frac{1}{2}$ mi. an hour. What is the distance between the two places?

2. My crop of wheat this year is $16\frac{2}{3}\%$ less than it was last year. Find my last year's crop if I raised 2760 bu. during the two years.

3. If $.62\frac{1}{2}$ of a cargo is worth \$11,250, what is the value of $87\frac{1}{2}\%$ of it?

4. A certain principal, at a certain rate per cent, amounts to \$1181 in 5 yr., and \$1339.80, at the same rate, in 9 yr. Find the principal and rate.

5. Find the value of a car load of wheat weighing 12,015 lb., at 78¢ a bushel.

6. If 8 men can do a piece of work in 10 da., how many men can do $\frac{5}{8}$ of the work in 5 da.?

7. How much will it cost to slate a roof 42 ft. long, the length of the rafters on each side being 30 ft., at \$8 per square?

8. A brick wall contains 2112 cu. ft. If it is 18 in. thick and 16 ft. high, how long is it?

9. What part of 10 A. 140 sq. rd. is 7 A. 80 sq. rd.?

10. How many board feet are there in 24 pieces of timber, each 12 ft. long and 13 in. square at the ends?

11. How much will it cost to line the sides and bottom of a tank 6 ft. long, 4 ft. wide, and 3 ft. deep with zinc worth 24¢ per pound, allowing $3\frac{1}{2}$ lb. to cover a square yard?

12. Mr. A. owning 60% of a farm sold $66\frac{2}{3}\%$ of his share for \$3000. What was the value of the farm and of the part Mr. A. had left?

13. How much must a plough, costing \$7.20, be marked so that 10% may be deducted from the marked price, and a profit of 20% be made?

LESSON 98

1. If $\frac{2}{3}$ of $3\frac{3}{4}$ lb. of sugar cost 20¢, what is the cost per pound?

2. If \$9 $\frac{3}{4}$ will buy $1\frac{5}{8}$ cords of wood, how much wood can be bought for \$27?

3. If $3\frac{1}{2}$ acres of land yield $7\frac{1}{3}$ tons of hay, at the same rate how many tons will $10\frac{1}{2}$ acres yield?

4. Wilton can row a boat $6\frac{2}{3}$ miles in $1\frac{1}{3}$ hours. At the same rate, how far can he row in $2\frac{1}{3}$ hr.?

5. A farmer gave $6\frac{1}{3}$ bu. of wheat for $3\frac{1}{6}$ yd. of cloth, at \$1 $\frac{1}{6}$ per yard. Find the cost per bushel of the wheat.

6. 6 is $16\frac{2}{3}\%$ of a certain number. What is $35\frac{2}{3}\%$ of the number?

7. A owns .5 of a farm, B owns $37\frac{1}{2}\%$, and C owns 50% of the remainder. What part of the farm does C own?

8. $\frac{1}{4}$ of an inch is what per cent of a yard?

9. A real estate agent received \$150 for selling a piece of land. How much did he receive for the lot, his rate of commission being 5%?

10. A tax collector, after deducting his commission of 5%, paid into the treasury \$11,875. What was the whole amount collected?

11. An architect charged $2\frac{1}{2}\%$ of the cost of a house for making the plans and specifications. If the architect received \$225, how much did the house cost?

12. If I pay \$.02 $\frac{3}{4}$ tax on each dollar, how much do I pay on my house which is valued at \$2500?

13. A man bought a bill of goods for \$120 and sold it for \$240 less $33\frac{1}{3}\%$ and 10%. What was his gain per cent?

14. If the value of $12\frac{1}{2}\%$ of an article is given, how can the value of $87\frac{1}{2}\%$ of it be found?

15. What is the ratio of 3 cu. ft. to 2 cu. yd.?

16. Albert sold his knife for 15¢, which was $\frac{3}{4}$ of what he paid for it. Find the cost of the knife and his loss per cent.

LESSON 99

1. Find the amount of \$1200 for 10 mo. 15 da. at 6%.

2. A man paid \$1000 for insuring a block of buildings for $\frac{3}{4}$ of their value at $2\frac{1}{2}\%$. Find the value of the block.

3. Find the difference between a single discount of 20% and two successive discounts of 10% and 10% off a bill of \$500.

4. If 12 A. of land cost \$144, how much will $\frac{5}{16}$ of 160 A. cost?

5. How many bushels of apples can be bought for \$230 $\frac{5}{8}$ if 13 $\frac{1}{2}$ bu. cost \$30 $\frac{3}{8}$?
6. 25% of 1120 is 6 $\frac{1}{4}$ % of what number?
7. I sold a dozen bananas costing 18¢ for 24¢. What per cent did I gain?
8. If I sell an article that cost me \$1 for \$2, what per cent do I make?
9. Find the G. C. D. of 504, 672, and 1260.
10. Harrison Welter paid me \$94.92, which is 28% of what he still owes me. How much did he owe me at first?
11. Find the ratio of the G. C. D. of 484 and 1146 to their L. C. M.
12. From a barrel containing 36 gal. of sirup, all but 4 gal. was sold. What per cent was sold?
13. A man spent \$3.52 for a pair of shoes, which was 7 $\frac{1}{3}$ % of his money. How much money had he left?
14. If $\frac{3}{4}$ of a bushel of onions is worth \$ $\frac{3}{10}$, how much is $\frac{3}{4}$ of a bushel worth?
15. 62 $\frac{1}{2}$ % of \$19 $\frac{1}{5}$ was paid for an overcoat. How much did it cost?

LESSON 100

1. Find the capacity of a cylindrical standpipe the altitude of which is 36 ft. and diameter 10 ft. Allow 1.336 cu. ft. to the gallon.
2. Find the entire surface of a square pyramid whose base is 6 ft. long and slant height 15 ft.
3. Change 157.5 gal. to bushels.

SUGGESTION. — $(157.5 \times 231) \div 2150.42 = Ans.$

4. How many board feet are there in 32 joists 3 in. \times 10 in. and 20 ft. long?
5. Divide 312 mi. 42 rd. $4\frac{1}{2}$ yd. by 6.
6. Change $\frac{5}{8}$ to a decimal. What is a decimal?
7. What per cent of 54 is 20% of 45?
8. $\frac{5}{8}$ of \$18 is $\frac{5}{8}$ of the sum of money a man paid for a suit of clothes. Find the cost of the suit.
9. Find the value of 2480 lb. of wheat at $87\frac{1}{2}\%$ a bushel.
10. A man insured a vessel worth \$18,600 for $\frac{5}{8}$ of its value, at $1\frac{1}{5}\%$, and the cargo, worth \$25,800, for $\frac{3}{4}$ of its value, at $\frac{3}{4}\%$. How much did he pay?
11. An agent sold a lot of grain on a commission of $2\frac{1}{2}\%$. If he received \$158, what was the amount of the sale?
12. I bought 240 tons of hay at \$12 a ton and sold it at \$15 a ton, taking in payment a 90-da. note, without interest, which I had immediately discounted at bank at 6%. Find my gain.

LESSON 101

1. A merchant bought potatoes at 50¢ a bushel. At what price per peck must he retail them in order to gain 20%?
2. If 12 A. of land cost \$360, how much will $18\frac{3}{4}\%$ of 80 A. cost?
3. How many rods of fence will inclose a field containing 15 acres, the length being 60 rd.?
4. What is a prime number? Name the prime numbers from 1 to 61.
5. 5 qt. is what part of $\frac{1}{2}$ bu.? What per cent?
6. $\frac{5}{8}$ of \$1 is what per cent of $\frac{1}{8}$ of \$5?

7. State the rule for finding the convex surface of a prism.

8. Find the cost, at 25¢ a yard, of fencing a rectangular field containing 24 A., if its width is 60 yd.

9. Find the number of posts required for a fence around a piece of ground 875 ft. by 910 ft., if the posts are to be set 7 ft. apart.

10. What will be the cost of the flooring required for two rooms 18 ft. by 22 ft. and 24 ft. by 30 ft., respectively, at \$24 per M., the flooring to be $1\frac{1}{4}$ in. thick, adding $\frac{1}{5}$ for waste?

11. Define *weight*. How many English systems of weight are there?

12. How many grains are there in a Troy pound? Apothecaries' pound? Avoirdupois pound?

13. For what is Troy weight used? Avoirdupois weight? Apothecaries' weight?

14. How many cubic feet are there in a stick of timber 8 in. by 8 in. and 24 ft. long? How many board feet?

15. Express $\frac{5}{8}$ sq. yd. as square feet. $\frac{4}{11}$ sq. rd. as square yards.

16. How many bushels will a bin hold that is 5 ft. square and 6 ft. deep? How many gallons will it hold?

LESSON 102

1. To gain 20%, how must goods be marked that cost 10¢? 20¢? 90¢? \$1.40? \$3.50?

2. A retail dealer bought a lot of hardware for \$960, at $12\frac{1}{2}\%$, $8\frac{1}{3}\%$, and 5% off. Find the net cost.

3. I bought 24 bbl. of cider, and sold it at a profit of $7\frac{1}{2}\%$ per gallon, thereby gaining \$81. Find the number of gallons in each barrel.

4. A tax of 18 mills on the dollar produced \$8662.50. Find the value of the property.

5. How many acres are there in a piece of land 1000 ft. square?

6. The Lehigh Valley Coal Co. put into my cellar 5 loads of coal weighing as follows: 2360 lb., 1965 lb., 2164 lb., 2280 lb., 2275 lb. How much did it cost me at \$3.25 a ton? (2000 lb. = 1 ton.)

7. A cellar 42 ft. long and 24 ft. wide is flooded to the depth of 8 in. How many barrels of water are there in the cellar?

8. How many yards of lining $1\frac{1}{4}$ yd. wide will be required to line $7\frac{1}{2}$ yd. of cloth $\frac{3}{4}$ yd. wide?

9. What is the difference, in cubic inches, between 5 qt. dry measure and 5 qt. liquid measure?

10. Mr. Alexander bought an automobile for \$600. After using it for a few months he sold it for 70% of its cost. The sum that he received for it was $87\frac{1}{2}\%$ of the sum he paid for a new automobile. How much did he pay for the new one?

11. Find the exact number of days from July 4 to Jan. 1.

12. How many degrees are there in a right angle?

13. 30° is what per cent of a circumference?

14. What is the length of an arc of 30° of a circle if the diameter of the circle is 4 ft.?

15. A diamond dealer paid \$125 for the insurance of diamonds worth \$5000. What was the rate?

16. What is insurance? What are taxes? Real estate?

17. What is a sector of a circle?

18. A sector of 45° of a circle is what per cent of the circle?

LESSON 103

1. The hour and minute hands of a clock form an angle of how many degrees at 3 o'clock? At 4 o'clock? At 2 o'clock? At 10 o'clock?

2. Find the entire surface of a square pyramid whose slant height is 20 in. and side of base 12 in.

3. Find the entire surface of a cone whose slant height is 30 in. and whose diameter at base is 10 in.

4. A note for \$1200, dated Jan. 10, payable in 60 da., with interest at 4%, is discounted at bank March 3, at 5%. What are the proceeds? No grace.

5. Find the face of a 60-da. note whose proceeds will be \$900 when discounted at 6%. No grace.

6. A note for \$1600, due in 3 mo., without interest, is discounted at 6%. Find the discount and proceeds. What rate of interest does the bank actually receive? No grace.

7. What is the cost of a sight draft for \$800, at $1\frac{1}{2}\%$ premium?

8. What is the cost of a 30-da. draft for \$900, premium $1\frac{3}{4}\%$, interest 6%?

9. Define proceeds; bank discount; payee; indorser; maker; days of grace; protest.

10. In what time will any sum of money double itself at 5%?

11. How long must a pile of wood be to contain 4 cd., if it is 4 ft. wide and $2\frac{1}{2}$ ft. high?

12. Mr. Rice's prices are $33\frac{1}{3}\%$ above cost. If he allows me $16\frac{2}{3}\%$ on my bill, what per cent profit does Mr. Rice still make?

13. What principal will gain \$19.60 in 1 yr. 9 mo., at 8%?

TABLES

LONG MEASURE

Long Measure is used in measuring lines or estimating distances.

The units employed in measuring length are, the *inch*, the *foot*, the *yard*, the *rod*, the *mile*, the *link*, and the *chain*.

LONG MEASURE	SURVEYORS' LONG MEASURE
12 in. = 1 ft.	7.92 in. = 1 li.
3 ft. = 1 yd.	25 li. = 1 rd.
$5\frac{1}{2}$ yd. } = 1 rd.	4 rd. } = 1 ch.
$16\frac{1}{2}$ ft. }	66 ft. }
320 rd. = 1 mi.	80 ch. = 1 mi.
1 mi. = 1760 yd. = 5280 ft. = 63,360 in.	

OTHER MEASURES. — 12 lines = 1 inch; 3 barleycorns = 1 inch; 4 inches = 1 hand, used in measuring the height of horses; 3.3 feet = 1 pace, used in approximating distances; 6 feet = 1 fathom, used in measuring depths at sea; 120 fathoms = 1 cable length; 6086.7 feet = 1 knot, a nautical or geographical mile; 60 geographical, or 69.16 common miles = 1 degree of latitude or longitude at the equator; 40 rods = 1 furlong; 8 furlongs = 1 mile; 3 miles = 1 league.

The Surveyors' chain = 4 rods = 66 feet = 792 inches long. The Engineers' chain is 100 feet long, divided into 100 links of 1 foot each.

SQUARE MEASURE

Square Measure is used in estimating areas or surfaces, as land, boards, etc.

The units employed are: the *square inch*; the *square*

foot; the *square yard*; the *square rod*; the *acre*; the *township*; the *square mile*; the *square link*, and the *square chain*.

SQUARE MEASURE	SURVEYORS' SQUARE MEASURE
144 sq. in. = 1 sq. ft.	625 sq. li. = 1 sq. rd. or perch.
9 sq. ft. = 1 sq. yd.	16 sq. rd. = 1 sq. ch.
$30\frac{1}{4}$ sq. yd. } = 1 sq. rd.	10 sq. ch. = 1 A.
$272\frac{1}{4}$ sq. ft. } or perch.	640 A. = 1 sq. mi.
160 sq. rd. or perches = 1 A.	36 sq. mi. = 1 Tp.

CUBIC, OR SOLID, MEASURE

Cubic, or Solid, Measure is used in estimating all things that have the dimensions length, breadth, and thickness.

The principal units employed are the *cubic inch*; the *cubic foot*; the *cubic yard*. A cubic yard of earth is called a *load*.

TABLE

1728 cu. in. = 1 cu. ft.
27 cu. ft. = 1 cu. yd.
16 cu. ft. = 1 cd. ft.
8 cd. ft. } = 1 cd.
128 cu. ft. }

A *perch* of stone or of masonry is $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. wide, and 1 ft. high. It contains $24\frac{3}{4}$ cu. ft.

A *cord* of wood is a pile 8 ft. long, 4 ft. wide, and 4 ft. high. The *cord foot*, which is practically obsolete, is $\frac{1}{8}$ of a cord, or 16 cu. ft.

MEASURES OF CAPACITY

Measures of **Capacity** are used in estimating quantity of fluids and many dry substances.

There are two sets of measures of capacity, one for liquids and one for dry substances.

The standard unit of **Liquid Measure** is the *gallon*, which contains 231 cu. in. The standard unit of **Dry Measure** is the *bushel*. It contains 2150.42 cu. in. Dry measure is used in measuring grain, fruit, lime, etc.

LIQUID MEASURE

4 gi. = 1 pt.

2 pt. = 1 qt.

4 qt. = 1 gal.

DRY MEASURE

2 pt. = 1 qt.

8 qt. = 1 pk.

4 pk. = 1 bu.

A pint of water weighs about a pound. A cubic foot of distilled water weighs about 1000 oz., or 62½ lb.

The *barrel* and *hogshead* do not express fixed quantities; they vary in different states. In estimating the capacity of cisterns, reservoirs, etc., the barrel is generally considered to contain 31½ gal., and the hogshead 63 gal.

MEASURES OF WEIGHT

The **Weight** of a body is the measure of the earth's attraction for it.

There are four sets of measures of weight: *Troy*; *Avoirdupois*; *Apothecaries'*; and *Apothecaries' Fluid*.

Troy Weight is used in weighing jewels and the precious metals, as gold and silver. The unit of weight is the *pound*, which contains 5760 gr.

Avoirdupois Weight is used in weighing nearly everything except gold, silver, and jewels. The unit of weight is the *pound*. It contains 7000 Troy grains.

The *carat* is a unit of 4 imaginary grains employed in rating diamonds and precious stones, as the ruby, topaz, emerald, etc. The

term is also used to express the fineness of gold. Thus, gold 18 carats fine consists of 18 parts pure gold, alloyed with 6 parts of some other metal, the whole mass being divided into 24 equal parts.

TROY WEIGHT

24 gr. = 1 pwt.

20 pwt. = 1 oz.

12 oz. = 1 lb.

AVOIRDUPOIS WEIGHT

16 oz. = 1 lb.

100 lb. = 1 cwt.

20 cwt. = 1 T.

At the United States customhouses, in invoices of imported goods, and in the wholesale trade of iron and coal, the ton of 2240 lb. is generally used.

The following table will show the number of avoirdupois pounds in a bushel of the principal farm products, as fixed by law :

COMMODITIES	WEIGHTS	COMMODITIES	WEIGHTS
Barley	48 lb.	Oats	32 lb.
Beans	60 lb.	Potatoes	60 lb.
Clover seed	60 lb.	Rye	56 lb.
Corn in the ear	70 lb.	Timothy seed	45 lb.
Corn shelled	56 lb.	Wheat	60 lb.

Some other denominations in common use :

56 lb. of butter = 1 firkin.	100 lb. dry fish = 1 quintal.
84 lb. of butter = 1 tub.	196 lb. flour = 1 barrel.
100 lb. of nails = 1 keg.	200 lb. pork or beef = 1 barrel.

APOTHECARIES' WEIGHT

Apothecaries' Weight is used by physicians and apothecaries in prescribing and preparing dry medicines. The unit is the *pound*, which contains 5760 gr., like the Troy pound. Medicines are bought and sold by avoirdupois weight.

Apothecaries' Fluid Measure is used by physicians and apothecaries in prescribing and preparing liquid medicines.

APOTHECARIES'

WEIGHT	APOTHECARIES' FLUID MEASURE
20 gr. = 1 ℥.	60 minims (℥) = 1 fluid dram (f ℥).
3 ℥ = 1 ℔.	60 fluid drams = 1 fluid ounce (f ℥).
8 ℔ = 1 ⅔.	16 fluid ounces = 1 pint (O.) (Octavus).
12 ⅔ = 1 lb.	8 pints = 1 gallon (Cong.) (Congius).

TIME

The unit of Time is the *day*.

TABLE

60 sec. = 1 min.
60 min. = 1 hr.
24 hr. = 1 da.
7 da. = 1 wk.
365 da. = 1 common year.
366 da. = 1 leap year.
100 yr. = 1 cen.

The year is divided into 12 periods, called calendar months. The following table will show the names of the calendar months and the number of days in each:

TABLE

NAMES OF MONTHS	DAYS IN EACH	NAMES OF MONTHS	DAYS IN EACH
1. January	31	7. July	31
2. February	28 or 29	8. August	31
3. March	31	9. September	30
4. April	30	10. October	31
5. May	31	11. November	30
6. June	30	12. December	31

Four weeks constitute what is called a *lunar month*; 13 lunar months and 1 day make a common year, 365 da.

The year is also divided into periods of 3 months, each constituting what is called a season. December, January, and February form the winter season; March, April, and May, spring; June, July, and August, summer; and September, October, and November, fall, or autumn.

By committing to memory the following stanza, the number of days in each month may be readily remembered:

“Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except February alone,
Which has but twenty-eight in fine,
Till leap year gives it twenty-nine.”

NOTE.—In business transactions it is customary to consider 30 days as a month, and 12 months a year.

UNITED STATES MONEY

10 mills = 1 ¢.
10 ¢ = 1 d.
10 d. = \$1.
\$10 = 1 E.

ENGLISH MONEY

4 far. = 1 d.
12 d. = 1 s.
20 s. = 1 £.
21 s. = 1 guinea.

CIRCULAR MEASURE

TABLE

60 seconds (") = 1 minute (').
60 minutes = 1 degree (°).
360 degrees = 1 circumference (C.).

The term **Sign** is sometimes used to express 30°, from the fact that the ancients divided the zodiac into 12 parts

of 30° each, and represented each part by an arbitrary sign.

To distinguish these from minutes and seconds of *time*, the phrase *of arc* is employed. Thus, $30''$ is read, 30 seconds of arc.

COUNTING

12 units = 1 doz.

12 doz. = 1 gro.

12 gro. = 1 grt. gro.

20 units = 1 score.

PAPER

24 sheets = 1 quire (qr.).

20 quires (480 sheets) = 1 ream (rm.).

2 reams = 1 bundle (bun.).

5 bundles = 1 bale (B.).

ANSWERS

Page 5.—7. 90¢. 8. $18\frac{1}{2}$; $\frac{1}{2}$. 9. .8 oz. 10. $53\frac{1}{3}$ ¢. 11. \$1.68.
12. $1\frac{1}{3}$ %. 13. $12\frac{1}{2}$ %. 14. \$3.90. 15. \$3.60.

Page 6.—16. $19\frac{1}{41}$ %. 17. $39\frac{1}{41}$ %. **Lesson 2.**—1. \$125.43.
2. 240.5 mi. 3. 1260 cu. ft. 4. \$1098. 5. 9 in. 6. \$4.90.
7. \$115.71. 8. 5832. 9. $\frac{1}{2}$. 10. 88 bu. 11. 34.19 bbl.

Page 7.—12. 79.75 da. 13. 1 hr. $53\frac{1}{3}$ min. 14. 100 bd. ft.
15. \$19.44. 16. $\frac{1}{8}$ yd. 18. $19\frac{1}{4}$ yd.; $123\frac{1}{2}$ ft. **Lesson 3.**—1. \$30000.
2. 18 yd. 3. 180 rd. 4. 16 in. 5. \$135.

Page 8.—6. \$402. 7. \$2553.87. 8. \$477 $\frac{3}{8}$. 9. $29\frac{1}{2}$ sq. yd.
11. 91 mi. **Lesson 4.**—4. $1\frac{1}{10}$ da. 6. 14 yd. 8 in.

Page 9.—9. 373.33 cu. ft. 11. 67.2 cu. in. 12. 57.75 cu. in.
13. 62.22 cu. ft. 14. \$172.80. 15. \$18.78. 16. 634.52 gal.
18. 133.68 oz. **Lesson 5.**—4. 69.44 mi.

Page 10.—6. $26\frac{2}{3}$ %. 7. 40 mi. 8. $68\frac{1}{2}$ %. 9. 60%. 10. $2\frac{1}{4}$ %.
11. \$281.25. 12. 160. 13. 1280. 14. 200 ft. **Lesson 6.**—
1. 1061.85 cu. ft. 2. \$52.50.

Page 11.—4. \$11390.62 $\frac{1}{2}$. 5. \$304.50. 7. \$72. 9. Lose $6\frac{1}{4}$ %.
10. \$302.50 = A's; \$217.50 = B's. 11. 2%. 12. 3 T.; 12%.
Lesson 7.—1. 25%.

Page 12.—2. 6 cwt. 3. 1.9 mi. 4. $52\frac{1}{2}$ %. 5. \$4 loss. 6. 300.
7. 25%. 12. \$48. 15. $1625\frac{1}{4}$ lb. 16. .417 T.

Page 13.—17. $\frac{1}{15}$. 18. 5%. 19. $2932\frac{1}{2}$ lb. 20. 32 bd. ft.
Lesson 8.—1. 10%. 3. $9\frac{1}{2}$ %. 4. 24 rd.; \$315. 6. 7.639 ft.
7. \$15 $\frac{3}{8}$. 8. $71\frac{1}{2}$. 9. \$17 $\frac{1}{2}$. 10. 48 rd.

Page 14.—11. $7\frac{1}{4}$ ¢. 12. \$260. 13. $108\frac{1}{4}$ A. 14. \$12. 15. $12\frac{3}{8}$.
16. 9¢. **Lesson 9.**—1. \$150. 2. \$3600. 3. $5\frac{1}{2}$ %. 4. 14 sq. ft.

Page 15.—7. \$1335.84. 8. $63\frac{7}{8}$ ¢. 9. \$10.70 $\frac{5}{8}$. 10. \$1.75 $\frac{1}{2}$.
11. \$11.60. 12. \$7.87 $\frac{1}{2}$. 13. \$1.54 $\frac{1}{2}$. 14. $41^{\circ} 11' 25''$. **Lesson 10.**
—1. \$130. 2. \$18.85. 4. $7\frac{1}{2}$ bu. 5. \$322.46 $\frac{1}{2}$. 7. \$27.56 $\frac{1}{4}$.

Page 16.—8. \$1.15. 9. 9½. 10. 40 bbl. 11. 263½ lb. 12. 4½ bu. 14. 3½ hr. **Lesson 11.**—1. 62½%. 2. \$41.12½. 3. ⅓. 4. ⅓.

Page 17.—6. \$2570½. 7. ⅓. 8. 1800 rd. 9. \$31.83. 10. \$116.64. 11. 338625 m. 12. \$88.25. 13. 200.52 oz. 14. \$71.75. 16. 62741½ sq. yd. **Lesson 12.**—1. 136½ ft. 2. \$16.88.

Page 18.—3. \$21.204. 4. 11880 in. 5. ¼%. 7. 69.81½ sq. in. 8. 7½%. 9. 192. 13. \$1710. 14. 432. 15. \$419.10. 16. \$27.90. 17. 27 yd.

Page 19.—1. 14½ T. 2. 33½%. 3. \$6.07½. 4. \$36. 5. \$2½. 6. \$1200. 7. 96 bu. 8. 70. 9. 15½ ft. 10. 12 da. 11. 108 mi.

Page 21.—1. 11° 45' 36". 2. 103536". 3. 74° 11' 35". 4. 41° 57' 51". 5. 6° 33' 42½". 6. 8 in. 7. 154° 17' 8½". 8. 51° 24' 2".

Page 22.—9. 7.854 ft.

Page 23.—2. 69.16 mi.

Page 24.—6. 1625.26 mi. 7. 3250.52 mi. 8. 2973.88 mi. 9. 3319.68 mi. 10. 66½°; 4599.14 mi.

Page 25.—4. 16° 30' 11". 5. 98° 27'. 6. 63° 36' 43". 9. 21° 59' 57". 10. 5° 56' 30". 11. 138° 46' 54". 12. 30° 17' 56" east. 13. 90° 23' 3". 14. 73° 17' 45".

Page 27.—2. 1 hr. 39 min. 44½ sec. 3. 1 hr. 16 min. 19½ sec. 4. 44 min. 4 sec. 5. 55 min. 39½ sec. past 12 o'clock noon.

Page 28.—6. 1 hr. 51 min. 51½ sec. slower. 7. 59 min. 24½ sec. past 8 A.M. 12. 20° 41' 15". 13. 77° 28" west. **Lesson 20.**—1. 86° 32' 30".

Page 29.—2. 84° 30' 3". 3. 89° 52' 30" west. 4. 37° 30' west. 5. 12° 28' 26" east. 6. 13° 23' 44". 7. 7 min. 50½ sec. past 10 P.M. 8. 75° 9' 5". 9. 29 min. 37½ sec. past 4 A.M. July 25. 10. 20 min. 24½ sec. past 11 P.M. Thursday. 11. 5 min. past 1 o'clock A.M. July 27. 12. 53 min. past 7 o'clock P.M.

Page 33.—3. 15 min. past 2 P.M.; 15 min. past 1 P.M.; 15 min. past 4 P.M. 4. 4 min. 5. 9 min. 40 sec. 6. 8 min. 12 sec.

Page 34.—4. 1280 A. 5. 240 ch. 6. 60 A. 75 sq. rd. 7. 60.6 ch.

Page 35.—5. 110. 6. \$155.50. 7. \$90.88.

Page 36.—5. \$15.91. 6. 70. 7. \$30.30. **Lesson 26.**—3. \$81.65.

Page 37.—4. \$256.29.

Page 38.—6. 20 bd. ft. 7. 900 bd. ft. 9. 1008 bd. ft. 10. 114½ bd. ft. 11. 1280 bd. ft. 12. 1728 bd. ft. 13. 2½ cd. 14. 6 ft. 15. 316½ ft.

Page 39.—4. 127½, or 128 P. 5. \$45.37½. 6. \$101.25. 7. \$337.50. 10. 4050.

Page 40.—11. 31360. 12. 19110. **Lesson 29.**—5. \$ 15.120
6. \$32.08 $\frac{1}{2}$.

Page 41.—7. \$203.33 $\frac{1}{2}$. 8. 9548. 9. \$14.22. **Lesson 30.**—
4. 385.71 bu.; 384 bu. 6. 497.78 cu. ft.; 500 cu. ft.

Page 42.—8. 362.24 bu.; 360 bu. 10. 198.76 cu. ft.; 200 cu. ft.
11. 3.81 cu. ft. 12. 26.25 bu.

Page 43.—4. 2154.39 gal.; 2155.69 gal. 5. 440.65 gal. 6. 1469685.62
gal. 8. 210.54 cu. ft.; 210.42 cu. ft. 10. 119.39 bbl. 11. 80.28 bbl.

Page 44.—1. \$151.25. 2. \$21.06. 3. 900. 4. \$66.50. 5. 9 $\frac{1}{2}$ yd.
6. 440 sq. ft. 7. \$112 $\frac{1}{2}$. 8. 2 oz. 9. 500 lb. 10. .41 $\frac{1}{2}$. 11. 120.
12. 20%. 13. $\frac{1}{4}$; $\frac{1}{2}$.

Page 45.—15. 2. 16. $\frac{1}{4}$. 17. 41 bu. 18. $\frac{1}{16}$. 19. 1.30 P.M.; 2 P.M.
20. 12300. **Lesson 33.**—5. 22 $\frac{3}{4}$ bu. 7. 32¢. 8. \$8.25.

Page 46.—9. \$8.95. 10. 9.75 ch. 11. \$8.71. 12. 7 $\frac{3}{4}$ da. 13. 4.
14. 3.1416. 15. $\frac{2}{3}$. **Lesson 34.**—1. 1 $\frac{1}{10}$; 2 $\frac{1}{2}$. 2. 1 $\frac{1}{2}$. 3. 2 $\frac{1}{2}$.
4. \$100.92 $\frac{1}{2}$.

Page 47.—5. 41° 15'. 6. 4. 7. $\frac{1}{4}$. 8. $\frac{1}{2}$. 11. \$200. 12. 145 $\frac{1}{2}$.
13. 240 ft. 14. 47 A. 15. \$18 $\frac{1}{2}$. 16. \$5141 $\frac{1}{2}$. 17. \$150.
Lesson 35.—1. 510.

Page 48.—2. 510. 3. 255. 4. 8572 about. 5. \$410.50. 6. 560 T.
7. \$641. 8. \$10472 $\frac{1}{11}$. 9. 48. 10. \$3.15. 11. \$346.80; \$36.05.
12. 11 $\frac{1}{2}$. 13. \$17 $\frac{1}{2}$. 14. \$384.

Page 49.—1. \$46.84. 2. \$206.33 $\frac{1}{2}$. 3. 67.2 cu. in.; 57.75 cu. in.
4. 213 da. 5. 108 mi. 6. 250 mi. 7. 3730. 8. 4 bu. 2 pk. 3 qt. 1 pt.
9. 314.16 sq. rd. 10. 62.156 sq. ft. 11. \$2940. 12. 96. 13. $\frac{7}{16}$; $\frac{1}{16}$.
14. 1460. 15. .00175; 8540. 16. $\frac{100}{99}$; $\frac{8}{9}$; $\frac{7}{9}$.

Page 51.—6. Percentage 60; amt. 810; dif. 690. 7. Rate 12 $\frac{1}{2}$ %;
amt. \$1575. 8. Base \$845.60; dif. \$281.86 $\frac{1}{2}$. 9. Base \$1450; rate 8%.
10. 15%. 11. Base \$640; rate 5 $\frac{1}{2}$ %; amt. \$673.60. 12. 42%.
13. Per. $\frac{2}{3}$; amt. $\frac{3}{8}$; dif. $\frac{1}{8}$. 14. Rate 60%; per. $\frac{1}{8}$; amt. $\frac{5}{8}$; dif. $\frac{1}{4}$.
15. Rate 28 $\frac{1}{2}$ %; amt. 235 $\frac{1}{2}$ qt.; dif. 132 $\frac{1}{2}$ qt. 16. Base 712.5; amt. 1065.9;
dif. 359.1. **Lesson 38.**—1. \$1218.75. 2. \$450. 3. \$700.
4. \$666 $\frac{2}{3}$. 5. \$56.32.

Page 52.—6. \$5. 7. \$118.80. 8. 600 bu.; 13 $\frac{1}{2}$ %; 66 $\frac{2}{3}$ %. 9. 40%;
150%. 10. \$225. 11. \$131.68 $\frac{1}{2}$ stock; \$86 bonds; \$59.12 $\frac{1}{2}$ real estate.

Page 53.—12. \$59.50. 13. 93 mi. **Lesson 39.**—1. 36 mi.

126 rd. $13\frac{1}{2}$ ft. 2. 80 %. 3. 20 %. 4. \$22. 5. $60\frac{1}{2}$ %. 6. 400.
7. $62\frac{1}{2}$ %. 8. 1400 %. 9. 760 bu. 10. $6\frac{2}{3}$ %.

Page 54.—11. \$163.75. 12. \$729.37 $\frac{1}{2}$. 13. $2\frac{3}{4}$ gal. 14. \$6.75.
15. 400 bu. 16. 300. 17. $42\frac{2}{3}$ %.

Page 55.—4. Com. \$52.80; net pro. \$907.20. 5. Rate $4\frac{1}{2}$ %; amt. \$335.20. 6. Rate 5 %; com. \$1.84. 7. Base \$92.50; net pro. \$88.80.
8. Base \$190; rate 6 %. 9. Base \$650; com. \$53.30. 10. Base \$750; com. \$30. 11. Rate 5 %; com. \$28.

Page 56.—12. \$29.70. 13. \$437.50. 14. \$2410.68 $\frac{1}{2}$. 15. \$5623.04.
16. \$8800. 17. \$2538.90. 18. \$927. **Lesson 41.**—1. \$45.
2. \$530.60. 3. $5\frac{1}{2}$ %

Page 57.—4. $2\frac{1}{2}$ %. 5. $3\frac{1}{4}$ %. 6. 60 ¢. 7. \$468; \$720. 8. \$5600;
\$7000. 9. $4\frac{1}{2}$ %. 10. \$126. 11. 30 %; 5 %. 12. \$9.21 $\frac{1}{8}$. 13. $4\frac{1}{2}$ %

Page 58.—2. \$210. 3. \$2.07. 4. \$726 $\frac{1}{2}$.

Page 59.—7. $5\frac{8}{10}$ %; $2\frac{1}{4}$ %. 8. No dif. 9. $82\frac{2}{10}$ %. 10. \$787.50.
11. \$600. 12. \$3.62 $\frac{1}{2}$. 13. \$690.

Page 61.—4. \$6142.83 $\frac{1}{2}$. 5. $2\frac{1}{2}$ %. 6. \$2866000. **Lesson 44.**—
1. \$3090; \$43983.90; $1\frac{1}{2}$ %; $1\frac{1}{2}$ ¢; \$1.50; \$15. 2. \$127.50. 3. \$186.
4. \$286.50.

Page 62.—5. \$96.78 $\frac{3}{4}$. 6. \$6420000. 7. 1 %. 8. \$85000.
9. \$1443298.95. 10. 8 mills.

Page 64.—**Lesson 46.**—2. \$195. 3. \$224. 4. \$672. 5. \$336.
6. \$165.60.

Page 65.—7. \$3343.75. 8. \$37.05. 9. \$405.25. 10. \$9.50.
11. \$70.50. 12. \$529.20. 13. \$14.28. 15. \$123.48. 16. \$720.
17. \$1023.

Page 66.—3. \$43.75.

Page 67.—4. \$45.50. 5. \$60.75. 6. \$48.75. 7. \$183.60.
8. \$7140. **Lesson 48.**—1. \$10396.824. 2. $3\frac{1}{8}$ %. 3. \$3500.

Page 68.—4. \$472. 5. \$2484. 6. \$43166 $\frac{2}{3}$. 7. \$1272.

Page 69.—8. \$708.78. 9. \$154.40. 10. \$3713.60. 11. \$486.
12. \$9952. 13. \$10800.

Page 70.—2. \$359.55. 3. \$645.39. 4. \$1546.81.

Page 71.—6. \$28.53. 7. \$242.62. 8. \$199.07. 10. \$72.19.
11. \$38.04. 12. \$171.788. 13. \$47.547 int.; \$427.547 amt.
14. \$11.886 int.; \$48.686 amt. 15. \$4.62 int.; \$168.92 amt.
16. \$5.05 int.; \$309.65 amt.

Page 72.—3. \$38.88. 4. \$222.31. 5. \$1464.87. 6. \$53.608.

Page 73.—7. \$113.685. 8. \$31.96. 9. \$17.136. 10. \$14.468.
11. \$611.77. **Lesson 51.**—2. \$216.62. 3. \$142.21. 4. \$2120.69.

Page 74.—6. \$27.78. 7. \$3.99. 8. \$262.26. **Lesson 52.**—
2. \$14.50. 3. \$23.24. 4. \$97.20. 5. \$943.49. 6. \$423.55.
7. \$4212.40. 8. \$662.85. 9. \$8497.

Page 75.—10. \$8718.78. 11. \$10849.25. 12. \$2124.10.
13. \$306.27. 14. \$239.09. **Lesson 53.**—2. \$48.61. 3. \$3251.06.
4. \$449.238. 5. \$4321.05. 6. \$123.82. 7. \$43.60. 8. \$199.056.

Page 76.—9. \$9591.11 10. \$3754.83. 11. \$385.72. 12. \$425.88.
13. \$3106.30. **Lesson 54.**—1. \$7.40. 2. \$18.24. 3. \$14.23.
4. \$35.18. 5. \$104.70. 6. \$3930.49.

Page 77.—7. \$133.88. 8. \$382.04. 9. \$1889.40. 10. \$8800.56.
11. \$538.33.

Page 78.—13. \$162. 14. \$1434. 15. \$9027.72. 16. \$726.38.

Page 79.—17. \$8637.01. 18. \$468.11. **Lesson 56.**—2. \$380.
3. \$800. 4. \$1200. 6. 9%.

Page 80.—7. $10\frac{1}{2}\%$. 9. 6%. 10. 5%. 11. 5%. **Lesson 57.**—
2. 1 yr. 2 mo. 3. 1 yr. 9 mo. 4. 1 yr. 11 mo.

Page 81.—5. 5 yr. 10 mo. 18 da. 6. 3 yr. 3 mo. 7. 3 yr. 4 mo. 15 da.
8. \$131.48. 9. \$30.11. 10. \$9000. 11. \$493.566. 12. \$86.44.
13. \$2808.30. 14. \$724.73. 15. \$12.72. 16. \$467.82. 17. \$860.
18. 8 yr. 11 mo. 4 da. 19. 10%. 20. 12 yr. 8 mo. 21 da. 21. \$481.48.

Page 82.—22. \$17274.577. 23. 4 mo.

Page 83.—11. 4 mo.; \$243.60. 12. $4\frac{1}{2}\%$. 13. \$400. 14. \$360;
\$16.65. 15. 6 mo. 12 da. 16. 4%. 17. 5%; \$71.25. 18. \$550;
3 yr. 3 mo. 19. $4\frac{1}{2}\%$. 20. \$1200; \$1277. 21. \$765. 22. 7 yr. 8 mo.
23. 16 yr. 8 mo. 24. Sept. 1, 1918.

Page 85.—2. \$353.818.

Page 86.—3. \$3089.45. 4. \$469.16. 5. \$645.65.

Page 87.—6. \$981.59. 7. \$895.49. 8. \$968.80. 9. \$757.21.

Page 93.—1. \$98.50; \$1.50. 5. 80 da.; \$1.33 $\frac{1}{3}$; \$98.66 $\frac{2}{3}$.

Page 95.—2. Due Dec. 2, 1900; term of dis. 52 da.; dis. \$31.20;
pro. \$3568.80. 3. Due Aug. 8, 1901; term of dis. 64 da.; dis. \$10.45;
pro. \$969.55. 4. Due June 30, 1900; term of dis. 81 da.; dis. \$4.78;
pro. \$381.72.

Page 96.—2. Due Nov. 20, 1900; term of dis. 76 da.; dis. \$13.34;
pro. \$776.66. 3. Due Feb. 11, 1901; term of dis. 144 da.; dis. \$9.27;
pro. \$377.13.

Page 97.—2. Due April 18; term of dis. 107 da.; dis. \$12.55; pro. \$691.25. 3. \$9.71. 4. \$752.25. 5. \$48.95. 6. \$8225.58. 7. \$8928.75.

Page 98.—8. \$380.80. 9. \$487. 10. \$300.12. 11. \$875.168. 12. \$959.16. 13. \$677.235. 14. \$7621.14.

Page 99.—2. \$1206.02. 3. \$810.81. 4. \$642.51. 5. \$1441.66 $\frac{1}{2}$. 6. \$6815.33. 7. \$841.84. 8. \$94.40. 9. \$400.668. 10. \$12726.

Page 100.—1. 2 da. 15 hr. 2. 5280 sq. yd. 3. \$863.20. 6. \$979.225. 7. \$14400. 8. \$33.33 $\frac{1}{2}$. 9. 5 yr. 9 mo.

Page 101.—14. 8°. 18. 39 $\frac{1}{2}$ yd. **Lesson 69.**—1. 7.10 A.M. 2. 3 hr. 12 min. 3. \$742.40. 4. 85; 36 $\frac{1}{2}$. 6. 12 rd. 7. \$640.

Page 102.—8. Feb. 12; \$650; \$643.50; \$653.15. 9. \$10.44. 10. 15 A. 11. 6 $\frac{1}{2}$ rd. **Lesson 70.**—1. 150. 2. $\frac{1}{2}$. 3. 107 $\frac{1}{2}$ %. 4. 4800 lb.; 6083 $\frac{1}{2}$ lb. 5. 3900 lb.

Page 103.—6. \$440.66. 7. 16 $\frac{1}{2}$ %. 8. 63 da. 11. 6 $\frac{1}{2}$. 12. \$20. **Lesson 71.**—1. \$16.53 $\frac{1}{2}$ loss. 2. 1 $\frac{1}{2}$ %. 3. \$18250.

Page 104.—5. 14%. 6. \$1225. **Lesson 72.**—1. \$1.47 $\frac{1}{2}$. 2. $\frac{5}{8}$. 3. 25%. 4. 15840 times. 5. \$99.

Page 105.—7. \$4020. 8. 90. 9. 11 $\frac{1}{2}$ %; 900%. 10. 50%; 50%; 60%; 900%; 1000%. 11. 42 $\frac{1}{2}$ %. 12. \$5200. 13. 73 $\frac{1}{2}$ ¢. 14. 12 $\frac{1}{2}$ %. 15. 96¢. 16. \$9405. 17. \$140. **Lesson 73.**—1. $\frac{5}{16}$; $\frac{1}{800}$; $\frac{1}{2}$; 33 $\frac{1}{2}$ lb. 2. $\frac{1}{4}$; 25%.

Page 106.—3. 1 cu. yd. 9 cu. ft. 705 $\frac{1}{2}$ cu. in. 4. 40 cu. yd. 9 cu. ft. 1511 cu. in. 5. \$11790. 6. 44 $\frac{1}{3}$ %; 55 $\frac{1}{3}$ %. 7. 11 $\frac{1}{2}$ %. 8. 20%. 9. \$495; \$5. 10. \$495; 6 $\frac{2}{3}$ %. 11. 3024. 12. 1080 gal. 13. 11 in. by 7 in. by 3 in. 14. 50.2656 in.

Page 108.—1. \$100.12 $\frac{1}{2}$. **Lesson 75.**—2. \$803. 3. \$606.71. 4. \$1082.70.

Page 109.—6. \$345.066. 7. \$954.

Page 110.—2. \$320.40. 3. \$555.10. 4. \$2973.75. 6. \$1965.50. 7. \$997.50.

Page 111.—4. 6; $\frac{7}{9}$; $\frac{7}{12}$; 3 $\frac{1}{2}$; 21 $\frac{1}{2}$. 5. 3. 6. 35. 7. 4 $\frac{1}{2}$. 8. 4. 9. 8. 10. $\frac{1}{2}$.

Page 113.—1. 7. 2. 32. 3. 3. 4. 12. 5. 90. 6. 76 bu. 7. 280 yd. 8. 1 $\frac{1}{2}$. 9. 69 $\frac{2}{3}$. 10. 26.

Page 114.—3. \$168.

Page 115.—4. $6\frac{3}{4}$ hr. 5. \$356. 6. \$341. 7. 4000 lb. 8. 400 mi. 6 rd. 11 ft. 9. 91 bu. 10. 9 da. 11. \$47 $\frac{1}{2}$. 12. 19 $\frac{1}{2}$ da. 13. 44 $\frac{3}{4}$ ft. 14. 578.8 T. **Lesson 81.**—1. 41 $\frac{1}{2}$ bbl.

Page 116.—2. 66 $\frac{3}{4}$ T. 3. 379 $\frac{1}{11}$ bu. 4. \$11.255. 5. 880. 6. \$1743 $\frac{3}{4}$. 7. \$2571 $\frac{3}{4}$. 8. \$37.44. 9. 12 $\frac{1}{2}$ oz. 10. 200 rd. 11. 96. 12. 138. 13. 7920 times.

Page 118.—3. 192 cd. 4. \$1141. 5. \$11.50. 6. 31 $\frac{1}{4}$ lb. 7. \$44.10. 8. \$165. 9. \$1216. 10. \$600. 11. 38400. 12. 16 $\frac{1}{4}$ da.

Page 119.—2. 55; 66; 77. 3. 34; 51; 136; 153. 5. \$135; \$324; \$360. 6. \$1400; \$1600; \$1800. 7. 189 A.; 245 A.

Page 120.—8. \$1083; \$1805; \$2888. 9. 288 bu. corn; 180 bu. rye. 10. \$985.60; \$1056; \$1161.60. 11. 9180 bu.; 10200 bu.; 12240 bu. 12. \$7528; \$13174; \$16938. 13. 54; 108; 162; 216; 270. 14. 480; 640; 816. 15. 180 Java; 60 Mocha.

Page 123.—1. 208 sq. ft. 2. 175 $\frac{1}{2}$ sq. ft.

Page 124.—9. 720 sq. in. 11. 640 sq. ft. 12. 640 sq. in. 13. \$33.33 $\frac{1}{3}$. 14. 200 $\frac{3}{4}$ sq. ft.

Page 125.—15. 308.8 sq. ft.

Page 126.—9. 39.66 sq. ft. **Lesson 88.**—1. 185.808 sq. in. 2. 203.025 sq. ft. 3. 402.124 sq. ft. 4. 125.39 sq. ft. 5. 216 sq. in. 6. 16 ft.

Page 127.—7. 240 sq. ft. 8. 136 sq. ft. 9. \$66.24 $\frac{3}{4}$.

Page 128.—3. 180 sq. ft. 4. 6 $\frac{2}{5}$ sq. ft. 5. 9 $\frac{1}{2}$ sq. ft. 6. 9 $\frac{1}{2}$ sq. ft. 7. 3300 sq. in.

Page 129.—5. 162 sq. ft.

Page 130.—6. 8000 sq. ft. 7. 512 sq. in. 8. 100.53 sq. in. 9. 200 sq. ft. 10. 20361 sq. ft. 11. 308.992 sq. ft. 12. 1897.984 sq. ft. 13. 884.992 sq. ft.

Page 131.—**Lesson 92.**—1. 120 sq. ft.

Page 132.—2. 298.45 sq. ft. 3. \$3.35. 4. 113.097 sq. ft. 5. 72 sq. ft. 6. 72 sq. ft. 7. \$20. 8. 92 $\frac{1}{2}$ sq. ft.

Page 133.—1. 26 $\frac{1}{4}$ sq. ft. 2. 221 sq. in. 3. \$1115 $\frac{3}{4}$. 4. 46 ft. 5. 392.7 ft. 6. 29.32 sq. yd. 7. 107.2 sq. ft. 8. 40 rd. 9. 80 sq. ft. 10. 288 sq. in. 12. 8 sq. ft.

Page 135.—7. 64 cu. ft. 8. 48 cu. ft. 9. 40 cu. ft. **Lesson 95.**—1. 74 $\frac{3}{4}$ cu. ft. 2. 38.877 cu. ft. 3. 116.63 cu. ft.

Page 136. — 5. 3. 6. 263.894 sq. ft. 7. 21 sq. ft. 8. 9 sq. ft.
9. $\frac{2}{3}$. 10. 62.83 sq. ft. 11. \$100. 12. 768 cu. in. 13. 192 sq. ft.
14. 1226.976 sq. ft. 15. 150 cu. ft. 16. 616 sq. in. 17. 208.13 sq. ft.

Page 137. — 1. $6\frac{1}{2}\%$ 2. 16 yr. 8 mo. 3. $4\frac{1}{11}\%$ 4. $5\frac{1}{2}$ hr.
5. 715 bu. 6. \$1376.01. 7. \$2055.78. 8. 188236.

Page 138. — 9. $4\frac{1}{2}$ da. 10. 18 ϕ . **Lesson 97.** — 1. $10\frac{1}{2}$ mi.
2. $1505\frac{1}{11}$ bu. 3. \$15750. 4. \$870; 6%. 5. \$136.17. 6. 10 men.
7. \$201.60. 8. 88 ft. 9. $\frac{2}{3}\%$.

Page 139. — 10. 4056 bd. ft. 11. \$7.84. 12. \$7500; \$1500.
13. \$9.60. **Lesson 98.** — 1. 8 ϕ . 2. $4\frac{1}{2}$ cd. 3. 22 T. 4. $10\frac{1}{2}$ mi.
5. $\frac{2}{10}\%$. 6. 12.84. 7. .06 $\frac{1}{2}$. 8. $\frac{2}{3}\frac{1}{2}\%$.

Page 140. — 9. \$3000. 10. \$12500. 11. \$9000. 12. \$68.75.
13. 20 $\%$. 15. $\frac{1}{18}$. **Lesson 99.** — 1. \$1263. 2. \$5333 $\frac{1}{3}$. 3. \$5.
4. \$600.

Page 141. — 5. $102\frac{1}{2}$ bu. 6. 4480. 9. 84. 10. \$433.92. 11. $\frac{1}{133855}$.
12. $88\frac{2}{3}\%$. 13. \$44.48. 14. $\frac{2}{3}\%$. 15. \$12. **Lesson 100.** —
1. 21163.473 gal. 2. 216 sq. ft. 3. 16.918 bu.

Page 142. — 4. 1600 bd. ft. 5. 52 mi. 7 rd. 2 ft. 3 in. 6. .83 $\frac{1}{2}$.
7. $16\frac{2}{3}\%$. 9. \$36.16 $\frac{2}{3}$. 10. \$354.37 $\frac{1}{2}$. 11. \$6320. 12. \$666.
Lesson 101. — 1. 15 ϕ . 2. \$450. 3. 200 rd. 5. .31 $\frac{1}{2}$; 31 $\frac{1}{2}\%$. 6. 100 $\%$.

Page 143. — 8. \$206. 9. 510. 10. \$40.176. 14. $10\frac{1}{2}$ cu. ft.;
128 bd. ft. 15. $5\frac{1}{2}$ sq. ft.; 2 sq. yd. 16. 120.534 bu.; 1122.077 gal.
Lesson 102. — 2. \$731.50. 3. 45 gal.

Page 144. — 4. \$481250. 5. 22.956 A. 6. \$17.946. 7. 159.58 bbl.
8. $4\frac{1}{2}$ yd. 9. $47\frac{1}{2}$ cu. in. 10. \$430.77. 11. 181 da. 14. 1.047 ft.
15. $2\frac{1}{2}\%$. 18. 12 $\frac{1}{2}\%$.

Page 145. — 2. 624 sq. in. 3. 549.78 sq. in. 4. \$1206.658.
5. \$909.09. 6. Dis. \$24; pro. \$1576; $6\frac{1}{177}\%$. 7. \$812. 8. \$911.25.
10. 20 yr. 11. $51\frac{1}{2}$ ft. 12. $11\frac{1}{2}\%$. 13. \$140.

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